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A STUDY OF MYELINATION AND HOW IT HELPS IN UNDERSTANDING THE INFLUENCE OF STIMULUS ON THE DEVELOPMENT OF THE NERVOUS SYSTEM.¹

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It is the object of this paper to present a study of myelination and to show how it helps in understanding the influence of stimulus on the development of the nervous system.

I shall first say a few words about the early development of the nervous system, next summarize

some of the known facts concerning the myelination of the nervous system and its relation to functional activity, then I shall discuss the effects of stimulus both on myelination and on the development of the nervous system.

The Early Development of the Nervous System.

In the developing nervous system the proliferating germinal cells of the ependymal layer of the neural tube early differentiate into neuroblasts and spongioblasts, which later develop into the neurocytes and neuroglial cells respectively. The migration of neuroblasts to the cortex is most active during the third month of gestation and is complete before the fifth month; hence heterotopies, that is, the occurrence of islands of grey matter in places where they are not normally found, can originate only before this time.⁽¹⁷⁾ In the third month there is formed in the marginal layer a well-developed cortical layer. At the fourth month the neopallial

¹ Read at a meeting of the Section of Neurology and Psychiatry of the New South Wales Branch of the British Medical Association on December 3, 1936.

wall rapidly thickens, mainly owing to increase in fibres in the intermediate zone. At the end of the sixth month and the beginning of the seventh month differentiation and grouping of nerve cells have begun, and result in the formation of the six layers of the cortex.⁽¹³⁾ The formation of gyri and sulci takes place in about the seventh month; thus agyria must result from interference before this time.⁽¹⁷⁾

There are two theories as to the development of the nervous system; the following account of them is taken from Cunningham's "Anatomy".⁽¹⁸⁾

1. The neurone theory, which is the one generally held, is that each neurone is a separate unit and that there is no continuity between the substance of one neurone and that of another. The axone is held to grow out from a previously spherical and unattached cell and is able to push into surrounding tissue, as if it were guided by some instinct, and to find its way to the particular area of skin, muscle or gland *et cetera* where Nature intends it to go. This unknown force, which is supposed to stimulate the free-lying spherical cell to protrude a process to a particular cell to which it is destined to become attached, is sometimes assumed to be a chemical one, and is known as chemotaxis.

2. The second theory is that originally the protoplasm of the nervous system and other tissues are in free and uninterrupted continuity with each other. As other tissues move away from the nervous system, and as the nerve cells move away from each other, the protoplasmic strands which unite them are supposed to become stretched and elongated, and modification of these existing protoplasmic connexions forms both the dendrites and axones. This is borne out by the fact that soon after the neural tube becomes closed, the outlines of its constituent cells become blurred and then disappear, and a continuous protoplasmic network or syncytium is formed. Cunningham⁽¹⁹⁾ states that the known facts may be interpreted that when nerve current begins to traverse the syncytium, structural modifications occur around the nuclei of the cells affected and gradually spread along their processes so as to give the appearance, in sections stained by special methods, of processes growing out from each neurone (that is, maturation of the nerve cell takes place in response to nervous impulses). This second theory, which I shall call the syncytial theory, seems the more reasonable and is shown in the nature of the neuropil felt-work of short unmyelinated nerve fibres which permeates the entire nervous system and which also forms the basis of the reticular formations of the central nervous system. Herrick⁽¹⁴⁾ has shown that amongst this neuropil felt-work end the innumerable collateral branches given off from the axones constituting the main lines of direct conduction, and that each impulse which they transmit must influence the matrix common to all. Travis and Herren⁽¹⁵⁾ have shown that in the rat the nervous energy involved in producing reflex responses affects every part of the cerebral cortex.

This conception of the nervous system at maturity as being one large reticulation fits in well with the idea of its being originally a syncytium.

Probably by the seventh month of gestation all the neurocytes have been formed, and, if one accepts the syncytial theory, all the possible connexions between the various nerve cells (and there must be many such connexions) must already be present. We shall see that at this time the nerve paths subserving primitive and essential functions are already fully myelinated, while others, such as between cells of the association areas of the cortex, are represented only by very immature unmyelinated axones.

Both the axone and its myelin sheath increase in size as the neurone matures. At first the myelin sheath is but a thin covering and gives a grey premyelin stain with the Weigart-Pal method of staining, but it soon increases and gives the true dark blue myelin stain.⁽¹⁰⁾

The term axis cylinder is frequently used for axone, but originally it was reserved for that part of the nerve fibre which is encased in myelin.

Myelin is supposed to be secreted by the neuroglia and is a complex substance composed of glycolipins, phospholipins, galactose, inosite, potassium, sodium and calcium.⁽²⁾ Its function is thought to be insulating and protective, and it is thought that possibly it plays some part in the chemical processes involved in the act of nervous conduction.

Myelination of the Nervous System.

The following facts regarding myelination are mainly from the works of Flechsig⁽⁴⁾ and Keene and Hewer.⁽¹⁰⁾ Myelination first appears at about fourteen weeks' gestation in the following tracts: the afferent and efferent root fibres of the spinal nerves, all the cranial nerves except the cochlear, the fifth sensory and the optic, and also in Burdach's column and the medial longitudinal bundle. In all these myelination is well marked by the twenty-second week.

Closely following these, and at from fourteen to sixteen weeks, myelination commences in the two spino-cerebellar tracts and the anterior ground bundles of the cord.

At about twenty to twenty-two weeks myelination is seen in Goll's column, in the lateral and posterior ground bundles of the cord, in the connecting fibres between the postero-lateral region of the grey matter of the cord and the anterior horn cells, thus completing the reflex pathway through which foetal movements are initiated.

At twenty-two weeks the olive and cerebellar connexions start to become myelinated, and do so rapidly. At this time also the medial fillet starts to become myelinated and the cochlear and the fifth sensory.

At twenty-four weeks the *fasciculus retroflexus* is beginning to become myelinated, and between the twenty-fourth and twenty-sixth week the fountain decussation of Meynert.

Between the twenty-fourth and twenty-eighth week myelination is seen in the *ansa lenticularis*,

or at least the fibres from the striate body to the *nucleus subthalamicus*.

At the twenty-sixth week myelination begins in the *brachia conjunctiva*.

At the twenty-eighth week probably also Meynert's commissure undergoes myelination; this commissure connects the two lenticular nuclei and is the first hypothalamic commissure to become myelinated.

Thus at twenty-eight weeks, when the foetus is viable, the sensory and motor nerves, most of the sensory tracts in the cord and brain stem, and all the association tracts in the cord and brain stem necessary for essential reflex action are myelinated, but there is no cerebral control.

At about thirty-five weeks some myelination is seen under the central fissure and extending under both anterior and posterior gyri.

At thirty-six weeks myelination starts in the pyramidal tracts, but at full term this is still scanty, and even nine months after birth myelination is very incomplete and the myelin sheath comparatively thin; myelination is not complete before the second year.⁽¹²⁾

Some myelination is seen in the optic tracts at thirty-six weeks, but is even slight at full term.

Between the thirty-sixth and fortieth week myelination appears in Lissauer's tract, the rubro-spinal tract (it is not complete here till three months after birth), the external arcuate fibres, the pons fibres and the stria-thalamic fibres. During this time (thirty-six to forty weeks) myelination is also occurring in the primary areas of the cortex and in their projection fibres, in the following order, namely: (i) the region around the central fissure, (ii) the region around the hippocampal gyrus, (iii) the region around the calcarine gyrus, (iv) the region around the superior temporal gyrus.

At full term the cortico-pontine-cerebellar paths are becoming myelinated; myelination is slight at birth, and even at nine months it is incomplete, the fronto-pontine being less heavily myelinated than the temporal and occipital fibres at this date.

Thus at birth we find practically complete myelination of the motor and sensory nerves, the sensory paths and all the association tracts in the cord and brain stem necessary for essential reflex activity; we find commencing myelination in the pyramidal tracts, the projection systems and the cortico-pontine-cerebellar fibres. There is no myelination in the intermediate and final association areas of the cortex nor in their projection fibres.

The aberrant pyramidal fibres become myelinated three months after birth, and the olivo-spinal tract at about eight months; this corresponds to the time when the baby is beginning to maintain equilibrium and to perform purposive coordinate acts, such as crawling and walking.

About a month after birth, corresponding with the commencing myelination of their afferent and efferent projection fibres, occurs a gradual spread of myelination from the primary to the surrounding intermediate cortical association areas. From the intermediate association areas myelination gradu-

ally spreads into the final or silent cortical association areas with corresponding myelination of their afferent and efferent projection fibres. These silent areas show only slight myelination at eight months.

There does not seem to have been much work done on myelination after nine months, but perhaps we may find light from another source. The growth of the brain after birth is dependent largely on increase of cortex and white matter and to a less extent of the basal ganglia. The growth in these regions is due to the maturation of the nerve cells and fibres, in which an increase in size takes place in the cell bodies, in the axones and in their myelin sheaths; and even at nine months the majority of the nerve cells of the cortex are still immature and undifferentiated. As most of the nerve cells and fibres of the brain stem and some of the projection fibres of the primary areas of the cortex are mature at birth, the increase in brain size after birth should give us a fair idea of the rate and time of the maturation, that is myelination, of the nerve cells of the intermediate and silent association fibres and their projection fibres. We find that the rate of growth of the brain is very rapid during the first four years of life; it then slows down, practically reaches its full growth at seven years and practically ceases between the eighth and eleventh years.⁽¹¹⁾ From this it is probable that myelination of the association areas is most rapid up to the seventh year with a gradual slowing down to the eleventh year; but, as native intelligence continues to develop up to about sixteen years, it is probable that myelination of the higher association areas goes on up to this age and then gradually diminishes.

Halliburton⁽⁶⁾ writes:

The richness of the brain in myelinated fibres increases for many years after birth with the progress of intellectual development. Kaes states this continues up to forty years and that in old age the number diminishes.

From these facts and deductions we can see that myelination of the nervous system broadly follows its phylogenetic pattern, and also that there would appear to be a close correlation between myelination and the appearance of functional activity. Flechsig was the first to suggest such a correlation, and till recently it was considered that nerve fibres did not convey nerve impulses till they had received their myelin sheaths; but Gonzalez⁽⁶⁾ showed that a rat fetus of about nineteen days was capable of discrete reflexes showing an inhibitory action from the higher centres, and as myelination does not take place until several days after birth, he concluded that myelination was not a criterion of functional activity. Windle, Fish and O'Donnell⁽¹⁶⁾ have also proved that certain vestibular reflexes are possible in the cat before myelination of the nerve fibres involved takes place, and they conclude that myelination is not an antecedent of function.

So it is probable that nervous conduction takes place in the axone before myelination, but that it is an inexact and uncertain impulse, as in early disseminated sclerosis, when the axones have lost

their myelin sheaths; it is also probable that complete myelination indicates maturity of the nerve fibre and capacity to transmit exact and complete impulses. Thus, although myelination would not appear to be absolutely necessary for functional activity, its appearance does indicate when full and complete activity can take place, and must be a very close guide as to when a tract assumes complete functional activity.

Stimulation has the effect of hurrying myelination. Held⁽⁷⁾ made experiments on cats, dogs and rabbits, which are born blind, and found that if light was admitted to one eye by opening the lid, more myelination was subsequently found in the corresponding optic nerve than in that of the opposite side. In a child that was prematurely born at seven months and that lived for three weeks, Keene and Hewer⁽¹⁰⁾ found myelination in the pyramidal fibres, pons fibres and optic tract (which is never found in specimens at this stage of development) corresponding to that found at full term. Flechsig⁽⁸⁾ also showed that a child born at eight months had a month later more marked myelination of its optic nerves than a child born in the usual way at the ninth month. Thus it is probable that stimulus does play some part in bringing about myelination of the axone, that is, in bringing about maturation of the neurone.

The Effect of Stimulus on the Development of the Nervous System.

What part has stimulus played in the evolution of the nervous system, and to what extent does it influence its development?

All evolutionary changes in the nervous system have taken place because of its inherent capacity to lay down new nerve paths for adaptive reactions in response to the stimuli of environmental conditions which threaten its life. If one embraces the syncytial theory, it is easy to understand how particular nerve paths could have been laid down in response to the stimulus of nervous activity. This takes place in the following phylogenetic order: first the sensory paths, then the motor paths, and later the intercalated or association paths. Flechsig⁽¹¹⁾ found this same order in the myelination of the more recently acquired projection systems of the nervous system, namely, sensory paths, then motor paths and later association paths. In the older parts of the nervous system, for example the cord, although the sensory and motor nerve roots become myelinated simultaneously, the intersegmental association paths in the cord become myelinated later, indicating even there the old evolutionary order.

The sensory and motor nerves, the sensory paths of the cord and brain stem, the thalamic region and the association fibres in the cord and brain stem necessary to maintain life are well myelinated at birth, and although these paths developed in response to evolutionary stimuli, their pattern could have been but little influenced by stimuli in their development in the fetus. Nevertheless it is interesting to remember the early organization of

the sensory system in the fetus, and hence the possibility of sensory stimuli pouring in from the skin to the developing nervous system, but, however, from a constant environment and not likely to modify well defined nerve paths.

In the projection systems of the primary areas of the cortex and the motor tracts the majority of fibres become myelinated after birth, and, although stimulus may hurry myelination, it probably plays only a small part in their determination, as the functions which arise as a result of their myelination are practically a fixed pattern in all persons and their tracts are already determined by evolutionary influences.

I should like to remind you again that at birth probably all the axonal connexions of the cortical neurones are present, but are not all myelinated, and that each neurone has many such axonal connexions. It is also probable that even at this time slight diffuse nervous activity takes place over the whole of this network.

From birth a stream of sensory stimuli begins pouring into the central nervous system, and if the ideas about myelination are correct, the stimuli end in the primary sensory areas of the cortex, giving rise to the crude sensory images such as we assume occur in babyhood. Myelination gradually spreads from these primary areas to the surrounding intermediate areas, and it spreads at a time corresponding to that at which recognition and meaning are given to these crude sensations; and, as we know from psychology that recognition and meaning follow combination or association of sensory images, it would appear that in these intermediate cortical zones recognition and meaning are given to crude sensory stimuli. It is necessary to think of the spread of myelination from the primary association areas of the cortex not as a mere surface spread, but to visualize the primary area as the base of a cone which has its apex in the thalamus, the body of the cone being the afferent and efferent projection fibres, and extension of the myelination of the primary to the surrounding intermediate areas taking place by a gradual increase in size of the whole cone. Thus sensory stimuli spread to the intermediate areas not only from the primary areas, but also directly from the thalamus by afferent projection fibres. It is probable that in these intermediate areas the particular axonal connexions which eventually become myelinated are determined by the persistent and recurring emphasis of stimuli from the already organized parts of the central nervous system.

Although some recognition and meaning are attached to sensory stimuli in the first few months of life, concrete recognition and meaning must depend on the association of many cortical neurones, because even such an apparently simple process as the distinguishing of the primary colours does not take place till about the age of four or five years.

On the basis of the meaning and memory of sensory impressions and their association with

other impressions, the functions of speech and the other higher intellectual processes are gradually organized. As these higher functions are not present in animals, whose brains do not possess silent association areas, and as myelination occurs last in these areas in the human brain, it is probable that maturation of neurones in these areas is necessary for the functioning of the higher intellectual faculties.

If the nerve tracts on which depend simple recognition and meaning are laid down in response to particular persistent stimuli, how much more must stimulus influence the opening up of the axonal connexions on which the higher mental faculties depend? As an example one may instance the devastating effect of the deprivation of auditory stimuli on the development of speech, and how this can be somewhat compensated for by the opening up of cortical nerve paths by tactile and kinæsthetic stimuli, a method which is also used in the educating of mental defectives. Moreover, although the capacity for speech is present at birth, the form of speech depends on the country in which one is born, that is, although all the axonal connexions necessary for speech are present at birth, the particular axonal connexions brought to maturity, in other words, myelinated, depend on the type of environmental stimuli. And there is nothing to show that, even after the use of one form of speech for many generations, any tendency to this type of speech is acquired.

The whole of the cortex is connected by its afferent and efferent projection fibres with the thalamus and all the lower segmental centres, and although these are commencing to become myelinated at birth, they are probably not completely myelinated till many years after birth. These are the fibres by which the cortex influences, and is influenced by, the lower centres, and especially in those fibres which connect the intermediate and final cortical areas to these centres, stimulus must play a large part in determining which axonal connexions are emphasized and myelinated.

Although some degree of localization of function is indicated in the cortex by development and loss of functions in cerebral lesions, it is well to remember that definite cortical areas for specific mental functions do not exist, and that it is better to consider the cortex as merely a means for the elaboration of the functions of the under-brain and to think of the brain as an organ which always acts as a functional whole, and of consciousness as an expression of this total activity with dominant stimuli determining the emphasis of consciousness.

Herrick⁽⁹⁾ has said that the child brings with him into the world no mental endowments ready made, no knowledge, no ideas, no morals, but that these have to be developed anew in each generation under the guiding hand of education. Education begins at birth with the inpouring of sensory stimuli into the central nervous system, and I have tried to show how these stimuli affect the developing nervous system.

One may venture to speculate on the extent of the influence of stimulus on the nervous system. May it not be the force which not only initiates maturation of the nerve cell, but keeps the nerve cell alive, and without which the nerve cell deteriorates and finally dies?

Also it is difficult to see how specific infantile psychic experiences involving complex cortical reactions can be impressed on a brain in which no framework for such conceptions exists. The way in which harmful infantile influences must act is rather in regard to general excitability and fatigability of the whole nervous system, brought about by toxic, nutritional, traumatic or environmental influences, and also badly controlled and exaggerated organic and emotional habits.

I hope my remarks may have shown that there is no arbitrary division between hereditary and environmental influences and that the two merge into each other, that the evolution of the higher parts of man's brain commences at birth and is largely dependent on environmental stimuli, and that education is but a gigantic controlled evolutionary experiment.

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EMOTIONAL FACTORS IN HEALTH AND DISEASE.¹

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THE great difficulty at the present time of inducing the medical profession in general to widen its outlook in the recognition of the significance of emotional factors in the incidence of both health and disease, is the fact that human nature, naturally including our profession, is as ever loath to recognize itself.

¹ Read at a meeting of the Section of Neurology and Psychiatry of the New South Wales Branch of the British Medical Association on December 3, 1936.

People fought against the great biological discoveries of last century, but happily scientific integrity prevailed, and we had to accept the most unpalatable fact that we were all no more than intelligent animals; our discovery and ultimate acceptance of that fact showed that our intelligence was indeed something to be proud of.

It seems to me, however, that we have for too long ignored the implications of these biological discoveries. It takes unflinching courage to look human nature in the face, and when there arises a genius like Freud, who tries to do this in an honest scientific spirit, he is naturally howled down by the mob. Normal adult persons dare not admit the full strength of their instincts, now so happily covered over and sublimated into useful social channels. Once upon a time, early in the life of every human being, these instincts tried to express themselves naturally, and most of us learned more or less thoroughly that it just would not do; usually we learned it at the end of a strap. Anyhow, the suppression of these instincts has become inevitably entangled with memories too painful to be borne. Hence we see red and hotly deny the existence of these instincts, and when signs of them appear in our children (as they invariably do), out comes the strap; and so the good work of civilization goes on.

It is very much more comfortable to dismiss the discoveries of Freud and of other deep-layer psychologists as being too fantastic to merit serious scientific consideration, and to shrink from the discoverers as being "sex cranks" or something equally shocking. Fortunately, however, some few serious members of the academic and medical professions have been forced to get over their natural distaste for these deeper facts of human nature, and to see in them a new light in the treatment of social and individual maladjustments. The scientific training of our profession makes us readier than most people to accept new ideas, and the fact that the psychological side of medicine is as yet only imperfectly understood does not detract from the main issue, that there is a psychological side of great importance, and that at any rate we are on the right track when we look for suggestions in diagnosis to the growing volume of work in the field of medical psychology.

It hardly matters at this stage that one school of thought ascribes maladjustment mainly to the repression of the sexual instincts, another to the repression of primitive aggression and blood lust, and so on. The important thing is that they are all agreed that early and unsuccessful repression of instinctual life does take place in some manner yet to be determined, probably in as many different ways as there are individuals.

The point I wish to make is that for a wider diagnosis we must make some effort to realize more clearly the colossal implications of the struggle in each individual between primitive human instinct and the claims of civilization. We cannot draw a line and say: "Yes, that may be so in neurotic and psychotic individuals, but in a straightforward text-

book physical case it is all quite different", for the line can never be drawn absolutely, because the straightforward "organic" disease so often has its functional side too. The patient perhaps enjoys his illness as an escape from some temporary strain, and can easily be encouraged to prolong it beyond its normal course by too heavy an indulgence in the paraphernalia and jargon of illness, which this type of patient tends to enjoy. (One is constantly reminded that the secondary gain of every neurotic symptom is the greatest stumbling block to successful treatment. Every patient consciously detests his symptom, but in the obscure maze of childhood conflict the only way out for this particular individual was apparently the development of this particular symptom. The symptom is a compromise and is necessary to defend the ego against the too insistent demands of the instincts. Having developed it, however, he naturally makes the best of a bad job and gradually finds it useful in various secondary ways. The stammerer, for instance, hates his stammer consciously, but it gives him a certain immunity from criticism in the early vulnerable days, when the child's ambition and estimate of what he ought to be and do over-reaches his capacity. He is able rationally to feel that if only he didn't stammer he might be able to achieve something more. Even the anxiety neurotic has certain compensations. He usually has the sympathy and attention of his family and is excused from many little responsibilities on account of being generally regarded as not very strong. Where the family sympathy is strong the patient can play up to it in various ways and obtain great relief from his anxiety.) When this enjoyment of illness becomes rather obvious, first one person and then another in the environment begins to whisper the derogatory word "neurotic". Far more often the neurotic streak remains quite undetected, and the patient progresses triumphantly from one illness to another, surrounded by sympathy, and is a godsend to the family physician. These people are sympathetically held to be not very strong, "always picking up everything" *et cetera*, and rarely come under the criticism of being neurotic. What rage descends upon the head of the intrepid individual who dares to suggest this weakness! For weakness it is generally held to be, not merely an illness. Pneumonia is a misfortune, but creditable, whereas neurosis suggests frightful weakness of character and flabbiness of will.

How unjust is our attitude! Surely an individual is not to blame if he has, say, a drunken father and a bad-tempered mother, a combination of parents which will very probably lead to either neurosis or bad character development in a large proportion of the children. It is actually the weaker side of the normal person that makes this derogatory criticism of neurosis, the side which just escaped neurosis itself, in effect: "There, but for the grace of God, go I."

As we all have this side, it is no wonder that the general attitude to neurosis is one of contempt, and the neurotic himself, feeling this, tends to disguise

his neurosis as long as he can, even from himself. He often works up a fabric of minor maladies from which he suffers, and which explain to himself and possibly to his doctor most of his unpleasant sensations. And, of course, the minor maladies are real; a devitalized, generally anxious person naturally suffers from minor somatic disturbances. It may one day be an interesting field for investigation as to whether continual minor irritations of a specific nature may not ultimately lead to the development of serious organic disease. However, the fact remains that if these anxious devitalized persons find a compelling new interest or receive some effective psychotherapy, the minor maladies disappear, either permanently or until the new interest weakens or old anxieties are rekindled, and the vicious circle is set in motion again. It is an interesting fact that with, at the outset, the worst will in the world, the serious investigating side of our profession has been unable to dismiss as unsound these new ideas on the emotional factors in disease. We have disposed of the osteopaths and others as fundamentally unscientific, but we have not disposed of the Freudians and their offshoots in this way, for the very simple reason that they are not unscientific. They are still groping, but groping in the right direction, and their ideas, more or less accepted in the field of psychiatry, are, I firmly believe, destined to play a large part in the wider field of general medicine. When this happens, I sincerely hope that the psychiatrist will at last come into his own and not be regarded as rather a peculiar person, for some reason practising an odd specialty cut off from the main (and really important) body of medicine.

There is a fairly common attitude in medicine which says in effect: "Look for the physical basis in every disease", and which implies that if you cannot find it, it is still there, but belongs to some unknown stratum of knowledge. For we do, in spite of what some people think, really believe that we have something to learn. These believers in the physical cause, however, usually find it either in the form of an inflamed nerve, a proptosed bowel, or an over-active thyroid. This, then, quite clearly is the cause; the disease, whatever it may be, is the effect. On the other hand, there is the much more rare individual, the psychological extremist. He is usually a quack of some kind, or a Christian Scientist. He says: "Look for the psychological basis in every illness." Usually, but not always, he makes an exception of broken limbs *et cetera* (accidents being considered unconscious wish fulfilments). Occasionally, however, a qualified practitioner goes to these lengths, notably the late William Groddeck, of Leipzig. No doubt there are a handful of others.

Being in such a minority, these people are dismissed as cranks, while the physical fanatics are merely considered to be a trifle narrow. I think personally they are both equally wrong—victims of the causal fallacy. I consider that all disease

should be looked on as a pattern, usually taking the form of a vicious circle.

Often the physical side is the only important one from the point of view of diagnosis and treatment. Sometimes, too, the psychological aspect is the obvious one to attack, the emotional maladjustment being too obvious to ignore; but in between these there is a vast range of conditions in which the diagnosis is vague, and ordinary treatment or treatment on purely physical lines is unsuccessful, but for some reason the word neurosis is never mentioned. I think we are too frightened.

To be a little more specific, we have been very much concerned in the past with the seeds of ill-health, and but little with the soil. We have been searching for single and specific causes of a physical nature, mostly parasitic, and have believed that the development of parasitic or other diseases was not dependent in any way upon the soil, with perhaps one exception, that of tuberculosis.

That a state of the soil could be produced suitable to the parasitic growth, that the function of organs or the reflex coordination of the various viscera could be influenced by emotions and psychological factors had been little considered. One or two little everyday instances may help to show that the emotional life may have an influence in this way.

A small girl, aged five years, who had previously been healthy in every way, on the birth of a baby brother, showed a very strong reaction of jealousy towards him. Almost immediately she showed signs of acidosis, pale stools, vomiting, acetone in the urine *et cetera*, which persisted for some months, persisted, though not so markedly, despite the fact that the diet was regulated and that glucose *et cetera* were regularly administered.

Some months later the acidosis cleared up, and it is interesting to remember the surprise in the doctor father's voice when he remarked: "And wasn't it funny that the child's jealousy cleared up simultaneously with the acidosis."

I forbore to suggest that here we might have the old situation of the cart being placed before the horse, and that the solution of the acidosis problem was the child's adaptation to the emotional situation caused by her dethronement by the baby brother.

In this regard it is interesting to know that R. D. Gillespie has achieved the same result with dill-water in these acidotic children as others have with glucose; and the explanation of this is that the notice taken of the child, regular attention, special diet, medicine, being taken to the doctor *et cetera*, all indications to the child that a greater valuation has been placed upon him and that he once more has a place in the sun, are more responsible than the glucose and dill-water.

Another small child, with a marked separation anxiety, came up against a problem which activated this anxiety in her first year at school. The problem was a difficult one for her to solve. That night she had a nightmare and woke up in the morning trembling of lip and moist of eye, but with a determination to go to school and face the problem. This she did, sailing forth almost rigid with tension. Everything went well, but she returned home that night with a temperature of 104° F., and spent

a delirious night, the content of the delirium being the day's problem. She went off cheerfully to school next day with nothing but a mild coryza.

One can argue this case from two or three different points of view, and, of course, each one is correctly a factor in the illness.

A further case is that of a small boy, aged three years, of a power-psychology type, a Mussolini sort of child, not yet socially adjusted, on holiday with three women. He was a nasal child, one of those who is always sniffy, who ultimately develops adenoids, but who never previously or since had a sore throat. One day a strange child was introduced to the house, a curly-headed, blue-eyed Adonis, slightly older than our Mussolini, for whom the women all fell, to the neglect more or less of Mussolini. Lunch-time came, and Mussolini did not want any; he complained of a sore throat and was obviously feverish. He was flushed and had a temperature of 101° F.; he had a red, congested throat *et cetera*. On the departure of Adonis that evening Mussolini's temperature returned to normal, the throat cleared up, and his appetite returned. On each subsequent visit by Adonis, Mussolini developed the same reaction. One could, of course, say that Adonis was a carrier.

These three instances, and thousands like them, familiar to all of us, are suggestive and point to the fact of there being a multiple aetiology for illness.

I like to think that illness is a maladjustment of a patient to his environment. In the past, illness has always connoted physical changes in the organism, and it has been assumed further that the changes produced are the result of physical agencies. What I wish to emphasize is the fact that external irritants in consciousness can produce symptoms without the intervention of consciousness, and that emotions and ideas can produce symptoms just as well as physical agents.

I do not wish to suggest a psychological explanation or causation for all illness, but am simply issuing a plea for the recognition of our patients as psychosomatic unities and for the recognition of the multiple aetiology of illness; and I do suggest that the emotional lives of our patients are as worthy of investigation and examination as their physical bodies.

Every emotion, we know, has its visceral accompaniments, the paths being by way of the autonomic nervous system, the impulses and reactions thereby produced being conveyed without any conscious adjustment, and the reaction being dependent on an earlier and preformed pattern to that emotion.

We know experimentally of the psychological effect produced by stimulation of the sympathetic system on the variations in the rate of the heart beat, on the ventilation of the lungs, on the secretions and movements of the alimentary canal, on the thyroid gland *et cetera*; and we also know subjectively of the expansion of the chest in fear, the thumping of the heart in anger and excitement, the trembling of rage and the sinking feelings in the stomach from fear and anxiety. We also know of Crile's experiments and those of Cannon.

Further, comparatively recently there has been a great deal of investigation of the hypothalamic

area in the diencephalon, which is probably under direct cortical control, and there is reason to believe that this may also be true of the vasomotor and cardiac centres. It is also interesting to note that there are connexions from this area to the pituitary gland and that the pituitary secretes a thyrotropic hormone.

It is further interesting to note that stimulation experiments in the subthalamic region can produce thyrotoxicosis, spasmodic torticollis and duodenal ulceration, and it is noteworthy that in disease these conditions often have an emotional precipitant, if not an actual cause. Rather extraordinary in the light of this was the following case:

An extremely neurotic woman developed exophthalmic goitre that was treated surgically some six months later. This was followed by the development of a spasmodic torticollis. After eighteen months her cervical nerves were severed, with relief of her torticollis, but the poor woman is now the victim of gastric symptoms.

The importance of this region, which has been called the "seat of the personality", cannot be overstressed, and it would seem that we have at last worked back to the central origin and control of the whole autonomic-endocrine system. We seem to have gone backwards from the endocrine system, from laying stress on the secretions of the gonads, the thyroid gland, the pituitary gland, to the central control of the whole involuntary nervous and chemical systems of the body.

It is interesting to speculate on the effect on the development of the nervous system of the acquiring of a certain amount of cortical control over these involuntary automatic centres, and of the effect of this partial control on the well-being of the body as a whole, which is no longer, on account of social requirements, able to live automatically according to the instincts, as may have been possible in the past, when there was no voluntary control of these centres. It is also interesting to speculate on the autonomic nervous system as a whole, with a centre in the hypothalamic region, with its afferent and efferent systems, directing all the unconscious activities of the body in conjunction with the endocrine and chemical systems. We are still very much in the dark concerning these things, although masses of material are being acquired and will be linked up later.

Maladjustment, inability to adapt oneself to environmental irritants, produces tension and anxiety, and these are accompanied by the well-known physical concomitants of anxiety, and act through the sympathetic nervous system.

Let us consider the experiment of the feeding cat when introduced to the bark of a dog. We remember how mobility of the stomach ceases, secretions stop, and digestion is immediately arrested by the emotion of fear; and then let us consider our anxious patients with the chronic anxiety and tension of years, how poor is their appetite, how often they complain of flatulence, fullness, pain and indigestion. I would refer you to a recent paper by Millais Culpin on psychological factors in gastric

and duodenal ulceration, recently published in *The British Medical Journal*.

It is also interesting to learn of the more conservative attitude of some surgeons with regard to duodenal ulceration, and to hear that so many place worry as one of the chief aetiological factors. We remember again the stimulation experiments in the hypothalamic region—how stimulation can produce ulceration.

One may no doubt speculate on the periodicity of gastric ulceration—how it recurs with worry and anxiety, how it occurs in people of the obsessional type, how it occurs frequently in people who are professional motor-car drivers, people living in a constant state of tension, and how it clears up with rest in the sanctuary of the hospital bed when tension is relaxed, worry temporarily ceases, and the patient is relieved of responsibility because he is ill.

I remember a girl who complained of vague indigestion, who was obviously unwell, losing weight, complaining of anorexia, of pain after food, flatulence, fullness *et cetera*. She was diagnosed as suffering from chronic appendicitis, and her appendix was removed with but little benefit. Some little time later she developed slight exophthalmos, tremor and increase in the pulse rate, with slight diffuse enlargement of the thyroid.

The emotional side of this girl's life had never been examined, but when it was, an obvious source of conflict was discovered which she was unable or unwilling to solve. She was helped to face her conflict and to come to a decision, when her physical symptoms cleared up and she regained her normal weight rapidly.

The fact that some attribute the cause of ulceration to a streptococcus, others to allergy, others again to psychogenic causes, points, I think, to a multiple aetiology, and the recent discussions on the histidine treatment of ulceration are interesting from this point of view.

To pass for a moment to the other end of the alimentary canal, the rectum, and to that hackneyed theme, constipation. There is no organ more sensitive to the conditioned reflex than the rectum, and I venture to say no organ more readily influenced by suggestion. The same is true of other organs with involuntary automatic functions that have come under partial voluntary control, for example the bladder and the respiratory apparatus. For the emotional side we have to hark back to the nursery days, and we all know, although we may have forgotten, of the fuss and anxiety and importance associated with the function of defecation: the "do it for mother", "has he been a good boy today?" father's first question on return from work: "Did he do it?" *et cetera*. For the fantasies of the child concerning this function and the psychological effects thereof I must refer you to the deep psychology of early infancy.

However, in passing, I should like to issue a warning against the early and drastic training methods advocated during the last decade. How little actually this early training means, how often it breaks down, how relatively unimportant it is, and how the function becomes established of itself

at eighteen months to three years of age, we all know. How harmful it can be, we should know from experience.

A young man who had become inordinately interested in his bowels from a study of Press advertisements, commenced taking "Alophen" pills to secure a satisfactory result each day. When seen, he was taking twelve "Alophen" pills every night, with, he said, a poor result each morning. After reassurance and insistence that he should not take any more pills, assurance that it was quite unimportant whether his bowels were open for a few days or not, and after it was pointed out to him that his absorption in his condition was the only thing responsible for it, he was sent away and asked to return in ten days' time. He reported that he had had a motion satisfactory to him every day, and a follow-up proved his bowel condition to have been satisfactory some months later.

The susceptibility of the bowel to suggestion is amusingly reflected in a story by, I think, Crichton Miller, about an old lady who consulted him for constipation.

Under light hypnosis he suggested to her that her bowels should open every morning at 8.30. Some days later the lady rang to know if Dr. Crichton Miller could make it 9 o'clock, as 8.30 was always in the middle of breakfast.

One of the most entertaining articles on the subject appeared in THE MEDICAL JOURNAL OF AUSTRALIA some years ago, under the heading of "Aperientitis". I am quite sure that a powerful authoritative article in the daily Press would reduce the sale of aperients enormously.

The man with the most happily adjusted bowel is he who can never tell you offhand when his bowels were last opened.

I have never forgotten, as a resident medical officer, admitting a boy of twelve to hospital, who had not had his bowels open for fourteen days. How his healthy cheek and eye, his clear tongue, his flat abdomen and normal chart, and the boy's insistence that he did not know what all the fuss was about seemed to insult my training. Actually the boy had merely been too busy.

Spastic Colitis.

That the psychogenic factor is the principal factor in the aetiology of spastic colitis has been known for some time. In this connexion I am reminded of a staff officer, unmarried, in the overseas army, who rather naively told me the story of his spastic colon. (Incidentally this condition in recent years seems to have largely displaced mucous colitis.)

When I met him he was returning to active service from home, where he had been on three months' extended leave to have his abdominal condition investigated. After many tests, barium enemas *et cetera*, and much expense, his condition was diagnosed as spastic colitis. He told me that he liked the army, that it had been very good to him, and that he was originally stationed in X. There he developed a strong attachment to his colonel, who reciprocated his friendship, to such an extent indeed that when his colonel was transferred to Y, it was managed that the staff officer should be transferred too. He liked Y and the life of the army, and was very well and happy.

Some time later his colonel was recalled to a home station. From then on the staff officer was never well. The army irked him, Y began to pall, and he had a great deal of abdominal discomfort. His abdominal symptoms became so alarming indeed that he asked for and was

granted leave to go home and have his condition investigated. While at home his symptoms remained despite all treatment, except for a period of three weeks, when he went down to B, in the country, to visit his colonel. This convinced him that he would never be well in Y. The climate, the food, and so on, were quite unsuitable for his complaint. However, he could not afford to retire, and his colonel was trying to have him stationed at home; so at the time I met him he was returning to Y, to try again, with the satisfaction of knowing that if he could not stomach it (his own expression) he would be returned home. I casually suggested that possibly he would be better at B, with which he fervently agreed, without in any way associating his bowel condition with his attachment to his colonel. I imagine that by this time he is once more at home again on the staff of his old colonel, and has completely forgotten his colon.

Hyperthyroidism.

The nerve supply of the thyreoid gland comes from the middle cervical ganglion. Stimulation produces thyroxin in the gland. Hypothyroidism gives us myxoedema with hebetude, slowness in thought and action *et cetera*. Hyperthyroidism causes excitement, irritability of thought and action, also exophthalmos, dilated pupil and tremor. This result is produced by stimulation of the sympathetic, except exophthalmos and the tremor. Tremor is said to be due to stimulation of the parathyroids. The exophthalmos must come from the cervical sympathetic. So we have excessive secretion and excessive irritability. Cannon's experiments with the cat would suggest excessive secretion to be due to excessive sympathetic activity. This would suggest a big group due to psychogenic causes.

Further, we have the anterior pituitary gland with its hypothalamic connexions and thyrotropic hormone; and, thirdly, a toxic causation from a septic focus.

The psychogenic factor is disputed by Joll, but upheld by Morley and by Dunhill, who says that he has never seen an exophthalmic goitre in a happy woman.

There is in England a man who should be better known, called Israel Bram. He wrote a monograph, I think in 1925, called "Goitre Non-Surgical Types", and published reports of a series of 2,000 cases of exophthalmic goitre controlled by 40,000 basal metabolic rate estimations and watched over a period of nineteen years. Treatment consisted of psychological adjustment, rest from home, restriction of protein from the diet, and symptomatic medication. The only indications for operation were mechanical symptoms, pressure *et cetera*, malignant disease, insanity and moribund cases. In follows-up 67% of cures were reported over a period of six years. Bram's criterion of recovery was that the patient should have a normal weight, absence of tremor, normal pulse rate and normal basal metabolic rate.

Asthma.

Quite recently R. D. Gillespie has published an excellent article on the psychological factors in asthma, so for lack of space I shall refer you to his article and briefly mention a few points in theory.

The allergic state may be acquired by ingestion, inhalation, injection, contact or infection by a foreign agent, and can also apparently be an inherited characteristic. The state having been established, its operation depends on a trigger factor, and that this trigger factor may be a psychological one is admitted by the physical allergists. Failure to treat successfully the allergic side has been due to the dismissal of the psychological factor. Treatment on purely physical lines is mostly valueless.

In the physiology of the allergic states the phenomena are contractility of unstriped muscle and permeability of capillary walls. This may be produced nervously or chemically in asthma, migraine, angioneurotic oedema and urticaria. Latterly there is the theory of histamine and "H" substance and its neutralization by adrenaline (Nott and Burn's work).

The following is a classification according to Shaw:

1. (a) Allergic asthma, only as a result of exposure to the substance or allergen.
(b) Non-bacterial or chemical.
(c) Bacteriological, associated with chronic infection or focal sepsis (the mode of production may be nervous or infective or chemical).
2. Psychoneurotic. Psychological unrest.
(a) May be intercurrent with a physical condition, especially bacterial infection.
(b) May precipitate a latent allergy.
(c) May be purely psychological.

Perhaps a case or two may illustrate the psychogenic factor. For instance, when Aunt Matilda calls on our week-end asthmatic patient, let us not only scrap Aunt Matilda's feather boa, but also investigate the detestation with which she is viewed by our patient.

A girl, aged twenty-three years, who had had minor attacks of hay fever and asthma, suddenly became acutely ill with asthma. She was tested by her doctor, found to be sensitive to kapok and house dust, and was desensitized. During this period and later her severe attacks of asthma continued. The physician, who was mindful of the possibility of a psychogenic causation of asthma, discovered quite casually that she was looking after her brother-in-law's children, her sister having died. She had hoped to marry her brother-in-law, but he appeared to be undecided, and so things went on. The brother's sister, who was opposed to the marriage, took her away to the country, but her asthma became so severe that she was forced to return. Some time later she visited her doctor and expressed great pleasure at her recovery, saying she had not had an attack of asthma for two months. Just prior to leaving, she triumphantly exposed an engagement ring. Casual inquiry elicited the fact that she had been engaged to her brother-in-law for two months. So far she has remained well since that time.

Every dermatologist will tell us that in prurigo and eczema there is an environmental factor which is proved by removal. I should like time to talk about cardio-vascular conditions, fatigue states and the common neuroses, but this is not possible. The physical concomitants of anxiety are not appreciated apparently by most of us, or, if they are, we seem to feel that they are too vague and indeterminate for us to do anything very much

about them. However, I hope I have shown that there is sufficient evidence available to make us accept the facts of the multiple aetiology of illness.

One may find a purely psychogenic illness, or on the other hand a purely physical one, but in 90% of cases there is an intermingling. First, the primary condition may have a physical origin superimposed on a psychological condition, for example, giving the symptom complex of allergy and asthma. Secondly, the basic irritant may be psychological, operating through a physical mechanism presenting symptoms. Thirdly, equal significance may attach to each.

It may be impossible in some cases to disentangle the effects of focal sepsis and emotional upsets, for example, hyperthyroidism, fatigue states *et cetera*. As regards the investigation of the psychological side, one endeavours to elicit the psychotherapeutic factor, to help the patient get his conflict into perspective and to face the emotional realities of his situation, and if we can do this we have gone a long way towards removing symptoms. The patient frequently only wants integration over a short period, and no one has better opportunities of doing this than the general practitioner. But is he trained for such work? I think he should, and in time will be. Little harm can be done if only preconscious material is dealt with, and I would say that the only harm he could do would be by not attributing sufficient importance to the psychological factor.

I must, of course, admit the superficiality of all this, and that the treatment of the neurotic is *par excellence* analytic, and further, that deep psychology explains to us a lot of the why's and wherefores of our patient's symptoms; the reasons for selection of the different sites of disturbance *et cetera*; but in this country, where we have no public institutions for the analytic treatment of these types of patients, the number who can benefit from this form of treatment is limited. While admitting whole-heartedly that the Freudian criterion of cure is a magnificent ideal to aim at, one must admit that it is uneconomic and available at present only to the well-to-do.

I put in a plea, therefore, not for rushing off every unsatisfactory patient to the psychiatrist, but for every medical man to have sufficient knowledge of psycho-physical interactions to help his patients from both points of view. He needs to know only a little of the general effects of emotional tension and to recognize those cases in which this tension exists.

Fortunately a great many practitioners do this very completely without calling it psychology, but it would be a great help to the general public if the field of diagnosis were widened and new forms of treatment correspondingly devised. We might then aspire to take away some of the flourishing business of the herbalist, the faith healer, and other irregular practitioners who occasionally disturb our peace. For undoubtedly these people often give to their patients something which they do not get from us—a crude attempt at a wider diagnosis and general human understanding.

THE EMOTIONS AND FUNCTIONAL DISORDERS OF THE VISCERA.¹

By H. M. NORTH, M.B., Ch.M. (Sydney), D.P.M. (London),
Sydney.

If we observe the behaviour of a group of candidates awaiting an oral examination, we shall notice that many of them suffer from frequency of micturition. Without stopping to consider the possibility of affections of the urinary system, we say that the symptom arises from the peculiar emotional excitement associated with the expectation of the ordeal ahead. On the next occasion that he investigates a patient complaining of frequency of micturition and comes to the conclusion that the symptom is functional, the clinician should recall the foregoing experience and should reflect that until his investigations reveal an analogous emotional tension he has not as full an understanding of his patient as he had of the examinees.

Towards the close of the last century the James-Lange theory of the emotions was causing considerable discussion. This theory asserts that the felt emotion is essentially a mass of sensations arising from changes in the various bodily organs, including both viscera and muscles. James writes:

Each emotion is the resultant of a sum of elements, and each element is caused by a physiological process of a sort already well known. The elements are all organic changes, and each of them is the reflex effect of the exciting object.¹⁹

While admitting that James has considerably overstated his case, it cannot be denied that a widespread disturbance in the bodily organs (and James emphasized changes in the viscera) accompanies or is part of emotional excitement. This should have incited clinicians to argue back in the opposite direction by seeking an emotional cause for a disorder in a bodily organ when no other cause could be found. This appeared unnecessary in the face of the tacit assumption that an individual is usually fully aware of his emotions; but a little reflection will show that such an assumption is far from the truth.

While affect sustains and directs the cognitive process, the emotions themselves have so little cognitive value that it is probable that we can examine our emotions only by retrospection. By the time we have stopped to ask ourselves: "Am I afraid? Am I angry?" the feeling has largely evaporated and been replaced by one of curiosity or inquiry. How often do we see the signs of anger or vexation in a person who stoutly maintains that he is unmoved? The often heard remark, "He does not wish us to think he is pleased", reveals the intuitive grasp of this fact in respect of the more positive emotions. Similarly, the fearful man consistently puts on a brave front, though it is not difficult to read the signs of his terror.

¹ The Chairman's address delivered at the annual meeting of the Section of Neurology and Psychiatry of the New South Wales Branch of the British Medical Association on December 18, 1936.

During excitement the subject is too occupied with the external situation to have any time for introspection. This fact is well illustrated in the soldier, who, in the heat of action, is oblivious of a painful wound. The *Punch* cartoonist showed true insight when he depicted the domestic scene made by the professional sword-swallowing who had found a hair in his soup.

Expressed in other words, the subject's attention is so fully engaged with the exciting object, adjustment to the situation and its development, that no observation of his emotion or internal sensations is possible. Let us suppose that a bomb were to pierce the ceiling and explode in this room; how many of us would have the presence of mind to count our pulse or make observations on the other internal organs? Afterwards we might even have difficulty in accounting for the unmistakable evidence that the anal sphincter had relaxed and the rectum expelled its contents.

Again, let us suppose that I venture to intrude so far on a person overwhelmed with grief as to request him to try to recount his sensations in the interests of science. If I prevail on him, I have already distracted him from his grief; the object of his attention is no longer the contemplation of his irreparable loss and the blighting of his hopes, but the study of his internal sensations; his motive is no longer grief, but a scientific curiosity.

To sum up, then, we shall say that the exciting experience and the train of activities that it calls forth occupy the focus of attention to the exclusion of internal sensations. If, however, a separate element of the emotional excitement on account of its extreme obtrusiveness should force itself on the attention, it is likely to be attended to in isolation and not as part of a total emotional experience.

Visceral Changes Due to Emotion.

While we recognize changes in the cardiovascular system, such as flushing and pallor, rapid or suppressed action of the heart, as expressions of emotion, we often miss the point if we do not ourselves participate in the experience which has caused the excitement. But we are apt to forget that the alimentary system is also extremely sensitive to affective processes. The greatly improved appetite, digestion and assimilation that accompany a holiday we ascribe glibly to "change of air". But it is strange that the effect is very similar, whether the holiday is at the seaside or in the mountains. Surely we are subjected to atmospheric changes enough without leaving our homes! While not denying that atmospheric conditions do affect digestion, the preponderant influence of the holiday must be sought in the removal from daily cares into new and pleasant surroundings. The saying "laugh and grow fat" expresses the same truth.

Nausea or vomiting caused by disgust derives from the primitive reaction to discard a nauseous morsel which has been inadvertently swallowed, but we often forget that the same reaction of disgust is produced in man by a wide range of objects or situations often quite abstract in nature.

In illustration, I mention the case of a motorist, who, through an unhappy chain of events, had the misfortune to run down a woman; after the victim had been removed in the ambulance he walked into a near-by chemist's shop and vomited all over the floor.

We may contrast the secretion of salivary and digestive juices in Pavlov's dogs in response to a variety of stimuli (some as remote from food as the ringing of a bell, but all having in common that they mean food to the animal and arouse the strong feelings associated with feeding), with the total inhibition of secretion and of all digestive movements accompanied by closure of all sphincters that is displayed by the cat when it is aroused by fear or anger, as demonstrated by Cannon.⁽²⁾ One may recall here the famous shark case, in which a human arm, showing very little sign of digestion, was disgorged by a monster after many hours of captivity.

The popular belief that the dyspeptic is ill-tempered confuses cause with effect. The correct statement is that an ill-tempered person may expect to suffer from dyspepsia. I would command to the attention of those who treat dyspeptics by diet the ancient wisdom of the scriptural pronouncement: "Not that which goeth into the mouth defileth a man; but that which cometh out of the mouth, this defileth a man."

The Establishment of Visceral Disorders.

Ordinarily, the disturbances associated with emotional excitement do not greatly outlast the exciting experience, and we have now to consider how a disorder sufficiently serious to cause the subject to seek medical advice may be established.

The Direct Method.

In the less violent forms of emotion the excitement may be long continued or be repeated at short intervals. This would apply to a state of indecision or vacillation between two or more possible courses of action, discontent, *tedium vitæ*, feeling of insecurity of financial or social status, frequently repeated erotic excitement and so on. I cite a case in which a frequently repeated disgusting experience was the cause of the illness.

Mrs. F., seen at Lewisham Hospital on January 9 and 23, 1936, complained of intense nausea, choking sensation and retching without vomiting, the attacks recurring periodically and lasting one or two days. Inquiry showed that she had to offer asylum in her home to an alcoholic father-in-law, who was unemployed. She described his conduct during the bouts as disgusting and expressed anxiety as to the effect it might have on her children.

I hope you will pardon me if I now introduce a trivial personal experience. I have found for some time that I am liable to suffer from slight diarrhoea on the morning that I expect to appear in court as a medical witness. I ascribed this to some irritant matter in my diet and took castor oil, until the repeated association suggested a psychological cause. A state of excitement similar to that experienced by the examinees with frequency of micturition seemed a sufficient explanation.

Indirect Methods.

We saw above that, while emotional excitement as a whole was not attended to by the subject, separate elements of such excitement might force themselves on his attention on account of their extremely obtrusive nature. This obtrusiveness arises from the painful and arresting character of the visceral disturbance or from urgent call for evacuation.

Such symptoms may be recognized by the subject at their true value as part of his emotional upset, but in other instances, on account of the operation of other factors, such emotional disturbances become the starting point of long and disabling illnesses. I shall discuss some of these factors.

Suggestion.—We live in a health-conscious age of cancer campaigns, infantile paralysis campaigns, maternal welfare and infantile mortality campaigns, health weeks and so forth. The truth of the adage, "a little knowledge is a dangerous thing", is borne out again and again. While such education of the public is necessary, if we are to avoid tragic consequences, it is the duty of the medical adviser to be constantly watchful not to permit any doubts to linger in his own mind which prevent him reassuring his patient courageously and decisively.

We are assaulted on all sides—in trains, in trams, in theatres, on hoardings and in newspapers—by advertisements of patent medicines. Most subtle of all are broadcast advertisements, the announcers of which know just how to catch hold of functional symptoms and exploit them as the harbingers of disease. We now have superadded fear and apprehension with their train of visceral disturbances and so an ever-widening vicious circle.

To stress the power of suggestion I will recall to your minds Elkin's statement (and this is also attested by many other competent observers) that the medicine man, while exercising many useful functions in primitive societies, may sometimes abuse his powers and cause illness and even death by suggestion.⁽⁸⁾ Similarly, in civilized communities advertisers abuse powers that they have stolen from legitimate medicine to produce illness and death. They constantly build up false concepts of disease and inculcate the grossest superstition. Whether we call it spirit or devil with the primitive, or whether we call it catarrh or uric acid or blood pressure with the sophisticated, for the one as for the other it means possession by an evil intelligence intent on working his destruction.

The Method of Trial and Error.—As is well known, the facts of observation of animal behaviour and of experimentation under laboratory conditions demonstrate that chance movements or behaviour which produce satisfaction in the development of conative process, become, as it is expressed, "stamped in"; while those that produce no satisfaction are "stamped out". While this principle is well recognized with regard to bodily movements and general behaviour, observation of pathological material points to the conclusion that the same holds good of visceral movements and visceral

behaviour. Thus a blushing, a nausea or a tachycardia that accompanies some emotional excitement may by chance produce satisfaction in the development of a quite unrelated conative process. It becomes "stamped in" just as an appropriate external movement does and will appear again as a means to the end that it previously forwarded.

It is customary to explain the war neuroses as resulting from the conflict of the soldier's sense of duty or self-respect with the continual fears engendered by the dangers to which he is exposed. However, I am not aware that any attempt has been made to explain why just this contracture, this mutism, this tachycardia, this tremor and so on is chosen. I suggest that the method of trial and error by "stamping in" offers a very good explanation; a temporary physical disorder, whether caused by commotion or emotion, shows the way of escape from an intolerable situation.

The following example from civil life shows very clearly the operation of the method of trial and error to retrieve a desperate situation.

Edward, a young man in the early twenties, chose the occasion of the absence of his fiancée, Mary, on a visit to the country, to sip a little honey elsewhere, and also to prove his virile powers before assuming the responsibilities of a husband. After Mary's return, Edward set out on one bright Sunday morning to escort her to his home to dine with his family, but was confronted by the damsel whom he had betrayed, and her irate father. Edward had not only to submit to the humiliation of a complete exposure to his fiancée, but also narrowly escaped the indignity of corporal punishment.

After the departure of father and daughter, Mary made it clear that Edward need have no hope of ever obtaining her forgiveness; but in order to avoid a scandal she accompanied him home to dine with his family, with whom she was on very good terms. The meal had not proceeded far, when Edward rose from the table miserably ill, being overcome by an intolerable nausea.

The disturbance might have ended here, as in the case of the motorist, but subsequent events were destined to perpetuate a functional disorder by the method of trial and error. The cat in the cage had fortuitously touched a spring, which opened a door in the wall of blank despair. In the scene which followed, Edward's relatives now saw in his previous silence and dejection the portents of a dangerous illness, which had now burst forth in its full force. In this atmosphere none could doubt the depth of Mary's feelings, and the manifestations of her unspoken sympathy assured Edward that she would not be able to forsake him, at least while he suffered.

It was some fifteen months later that Edward consulted me at the Royal Prince Alfred Hospital. It had been necessary to abandon his employment and he had carried out one regimen after another prescribed by the different medical men whom he had consulted, but still without obtaining relief. Though Mary had not forgiven him, it was clear that she would not forsake him while he was ill.

After explanation of his symptoms, Edward was given the confident assurance that his stomach was perfectly normal and was instructed to adopt a liberal diet in place of the present very restricted one. He was also assured that he need have no fear of ultimately winning Mary; but since no man who was unemployed had the right to ask anyone to marry him, it was essential that he resume his employment at the earliest possible moment.

A few weeks later Edward reported that he was now regularly employed and could eat anything. His marriage was to take place as soon as he had saved sufficient money.

The Method of Circus Movement.—For the next method I propose to use the term "circus movement", borrowed from cardiology. Conative processes normally advance from step to step in a series, so that when one immediate end is satisfied this conation ceases and the next in the series arises and so on. However, it may happen that, either from external or internal causes, the process tarries at one link or at one small group of links in the series. Emotions now come into play that are appropriate to subsequent members of the conative series, but on account of the circus these are destined never to find expression in action. None the less, these new emotions are expressed in visceral disturbances and are likely to be frequently recurring on account of the persistency of the conative process in the face of obstruction.

Circus movement from internal causes arises very readily in the highly complex environment of the present day. The individual, as it were, becomes entrapped by his own sophistication and acts in a manner that can never give him adequate self-expression. He has misconceived his own nature. I shall give an illustration of a circus arising in the conative series associated with mating.

Miss K., aged thirty-four years, interviewed at the Royal Prince Alfred Hospital on December 18, 1935, complained of shaking and dry retching of recent onset. She also mentioned the following symptoms: sensation of a lump in the throat; flatulence; inability to eat for days, becoming "so weak that she could not stand up"; palpitation; sensation of her bed shaking in the middle of the night. She stated that she thought her heart was at fault because she woke up with her heart quivering. On inquiry, Miss K. revealed that she had been "keeping company" with a widower for the past twelve months. The affair had always been conducted with the strictest propriety, Miss K. finding her friend a useful escort to dances and picture theatres. Miss K. had always been treated with the greatest respect and was conversant with all her friend's affairs; she was convinced that he only awaited a suitable opportunity to propose marriage, which she did not intend to accept partly on account of home ties, though these were not really a serious obstacle.

The opinion was expressed that the patient's illness resulted entirely from emotional causes, and the advice was given either to break entirely with her friend or to be prepared to accept his proposal of marriage. Miss K. retorted that if she did give him up she would only find another "boy friend"; that she had always had a "boy friend" all her life and that she intended to continue to do so. She asked why it had never affected her in this way before with all the dozens of "boy friends" that she had had. It was pointed out that she seriously misconceived her own nature if she imagined that she could continue to go on like this. Such affairs might be all very well for "flappers", but she must remember that she was now a mature woman. It was probably now the time for her to consider and to make up her mind whether she intended to remain celibate or to marry. Either course seemed quite feasible, but her present illness should convince her that there was no middle course.

Four weeks later Miss K. reported that she was now engaged to be married and that she now felt well and happy.

If I leave this patient here, I run the risk of producing the impression that I wish to present an example of "repressed sex". But since I have repeatedly seen entirely comparable symptoms in persons of both sexes who were freely indulging in

sexual intercourse, I cannot accept that view. Though I have no direct proof, it does not seem difficult to reconstruct the gamut of emotions of which this woman was the subject. While not denying eroticism a place, I would stress tenderness and pity and pain sympathetically induced by the contemplated disappointment of her lover, and therefore self-reproach, as she is its cause. Then we must consider the peculiar emotions associated with home building and those a woman experiences on assuming the rôle of wife and matron. And I do not think it too far a call to postulate maternal tenderness and the cherishing of infants still in the distant womb of the "might-have-been". One must introduce also a complicating factor which enters into nearly all these disorders, namely, health-consciousness, which suggests a fear of illness and destruction.

External causes of circus movement are usually more obvious and include conditions such as bereavement, poverty, unemployment, isolation and imprisonment. A large group, in which internal and external causes cooperate in preventing the individual from finding self-expression, is represented in the recipients of compensation, pensions and benefits of social services, who avoid an active life on account of the danger of so losing these benefits.

The Method of Special Training.—This depends on one aspect of the laws of mental retentiveness, namely, that when objects of any special order are habitually attended to, perceptual discrimination for such objects becomes enhanced through the acquirement of new mental dispositions. G. F. Stout writes:⁽⁴⁾

It is to the habitual direction of attention that we must ascribe all special power of discriminating and interpreting sense-impressions which does not depend on superior delicacy in the organs of sense. A savage will discern a snake from a withered branch or distinguish and identify an animal in the distance, where a civilized man entirely fails. But careful investigation has failed to show any superiority in the eyesight of the savage. His greater power of discrimination in certain directions is due to practice beginning in childhood and continued throughout his life. The same savage, who can track game where his white companion can discern no trace of it, would be reduced to tears and despair if he were condemned to pick out the inverted s's on a page of print.

The special development of touch discrimination in the blind, shown, for instance, in the reading of raised print, is also due to the habitual direction of attention to tactal impressions. . . .

In many trades and professions special aptitudes of the same kind are acquired by special training. The steel-worker sees half a dozen tints where others see only a uniform glow. The seaman makes out the loom of the land where the landsman can detect nothing but an indefinite haze above the horizon line. The wine-taster can tell the vineyard by which any choice wine was yielded and the year of the vintage which produced it.

The thesis is here put forward that special discrimination of organic sensations develops in exactly the same way. It may be argued that organic sensations are of a different order and that in the cases mentioned above the special discrimination acquired affords the individual greater control

over his outside environment. This is true when the sensations are regarded from an objective biological point of view, but when they are regarded subjectively many advantages are obtained in a sophisticated environment by the acquirement of special discrimination in the domain of organic sensations, a large measure of control being exercised thereby over the immediate social *milieu*. In any case, it is by the habitual direction of the attention that the special power of discrimination is acquired. Undoubtedly there are parents and others who unwittingly train children from an early age to direct their attention to visceral sensations. This is what Robert Hutchison describes as vicarious hypochondria.⁽⁵⁾ The practical test of clinical observation also shows that special discrimination of organic sensations is in fact acquired in varying degrees.

Psychological theory has good grounds for holding that every experience produces some modification in neural structure, that this modification is confirmed and established by repetition of the same or similar experience, but tends to fade and die out in the absence of such repetition. We must assume that the special aptitudes in the trades and professions, of musicians, athletes, wine-tasters and so on depend on the acquirement of special neural patterns in the association areas of the cerebral cortex. It is the thesis here put forward that the special skill exhibited by hypochondriacs in appreciating their internal sensations is of the same order and depends on the acquisition of neural patterns in just the same areas of the nervous system.

If this view be correct, the prophylactic indications are obvious; as also the importance of correctly assessing at the earliest possible moment disorders of the nature here discussed and assuring that the patient adopts a correct attitude towards them. The ease with which such disorders are corrected in the beginning and the great difficulty of affording relief to confirmed neurotics is in accordance with the thesis put forward.

Visceral Disorders in the Psychoses.

In the psychoses there is profound disorganization of the subject's affective life. We find violent emotions surging up without apparent cause or with only very inadequate cause—fear, anger, rage, despair and so on. These carry with them severe visceral disturbances. It is especially in the incipient stages and in larval conditions that the patient runs grave risk of surgical interference with innocent organs. The risk is the greater because the patient and his relatives are only too ready to grasp at any straw in order to avoid acceptance of the fact that the illness is mental and often are more willing to permit surgical intervention than if a grave surgical emergency were present.

Concluding Remarks.

In conclusion, I should like to point out that considerations of space have induced me to present my material in a schematic fashion, as though one

specific cause operated in each neurotic illness. But I would issue a warning against any such view, believing as I do that every such illness has a multiple aetiology. Reading between the lines in my longer case records, it will be evident that several of the factors I have mentioned, as well as many others, must have operated in each of these patients. A meteorologist would be just as much justified in ascribing a thunderstorm to a single cause. Since the behaviour of all living organisms depends on the nature of the biological material, the most important single factor is surely the quality of the germ plasm inherited from the ancestors. You must not expect to gather grapes of thorns or figs of thistles.

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CEREBELLAR FUNCTION IN MAN.

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Some Opinions on Cerebellar Functions.

The main phases in the evolution of the modern conception of the functions of the cerebellum show, as is often seen in similar problems, a swing of opinion between two extremes, followed by a return to a more rational view intermediate between the two.

Many years ago Magendie stated that the cerebellum was the organ of equilibrium, and some time later Luciani described its functions in terms of his symptom triad—asthenia, atonia and astasia (ataxia), following its removal. Cerebellar afferent connexions bringing proprioceptive impulses from all parts of the body, especially the semicircular canals, were demonstrated; and Sherrington suggested for it the title "head ganglion of the proprioceptive system". The passing of its efferent fibres to every muscle of the body showed that its functions must be concerned with normal muscular action, and the abundant connexions to and from the cerebral hemispheres suggested that it was specially concerned in some way with voluntary movements. This suggestion has been confirmed by the demonstration of action currents in the cerebellar cortex during voluntary movements.

The results of investigation from a comparative anatomical standpoint (*vide* Wood Jones⁽⁶⁾) may be set out as in Table I. In this table possible functions of the various connexions are included.

In a general way the vermis and floccular lobes correspond to palaeocerebellum and the lateral lobes to neocerebellum, but no accurate anatomical

TABLE I.

Portion of the Cerebellum.	Function.	Connexions.		Possible Functions of Connexions.
		Efferent.	Afferent.	
Paleocerebellum consisting of vestibulo-cerebellum and spino-cerebellum.	Paleostatic system for equilibration (postural reflexes).	Roof nuclei to vestibular nuclei. Thence as vestibulo-spinal tract.	Vestibulo-cerebellar.	Labyrinthine reflexes.
			Spino-cerebellar. Nucleo-cerebellar.	Stretch reflexes from the muscles themselves.
			Olive-cerebellar.	Neck reflexes (?).
			External arcuate.	Skin reflexes (?).
Neocerebellum or cortico-cerebellum.	Neostatic system for control of antagonists, synergists and fixators in voluntary movement.	Dentato - rubro - spinal tract. Dentate - thalamo - cerebral fibres to cerebral cortex.	As above, and, in addition, the cerebro-ponto-cerebellar tracts.	Transmit the necessary impulses for the harmonious cooperation of the cerebrum and cerebellum in their control of voluntary movements.

division representing the two stages in phylogenetic development exists. Such a division is not to be expected because, as will be shown later, the cerebellum always functions as a whole.

From all investigations it seemed fairly certain that the cerebellum was concerned with equilibration and voluntary movements, though, of course, exactly how it played its part in these functions was quite unknown. So various writers invented to their own satisfaction, and students' sorrow, words and phrases, more or less vague, to explain the functions of the cerebellum. As examples⁽¹⁾ we have the following phrases: "synergic control", "central coordination station for proprioceptive reactions", "appears to be constantly exerting a stimulating or tonic effect upon the body muscles", and so on—all to some extent true, but not helpful in giving clear ideas to a student. In fact, they are the kind of phrases students in desperation learn off by heart for examination purposes, after a futile attempt at extracting some meaning from them.

Even as late as 1936 Hartridge⁽²⁾ still suggested that "the function of the cerebellum is to relieve the cerebrum of the necessity of giving detailed instructions for the carrying out of acts which are likely to be often repeated". He supposes that after the cerebrum has been employed in the voluntary effort of learning a complicated motor act, "the cerebellum takes over a little at a time the necessary group control of the movements". That this conception is quite wrong is almost certain. It would appear most unlikely that, after a cerebral cortical pattern of connexions has been acquired for the accomplishment of some complicated act—for example, even such a common act as walking—the cerebellum, by some mysterious process, "takes over" the job. Actually we now know that memories of movement patterns are stored in the intermediate frontal area of Campbell, immediately in front of the precentral gyrus. A lesion of this area results in that disorder of voluntary movement called apraxia.

At the time when everyone was talking about maintenance of muscular tone and bodily equilibrium by the cerebellum, a terrible blow came from the physiologists. The beautiful experiments on postural reflexes in decerebrate and thalamic animals were being performed (Sherrington, 1915, and Magnus). These reflexes were considered to be the basis of muscular tone and posture regulation, which corresponded fairly accurately with what the older writers meant when they spoke of bodily equilibrium. The cerebellum was then removed as well, and this operation was found to have not the slightest effect on any of these reflexes. Experimenters were driven to the conclusion that the cerebellum could not have anything to do with equilibrium or muscle tone. Opinion had switched from one extreme to the other.

However, physicians never really believed that the human cerebellum had nothing to do with tone, and today they explain almost every sign of cerebellar dysfunction in terms of hypotonia. No one who has examined a patient with an extensive unilateral cerebellar lesion, who has felt the weak, flabby muscles on the side of the lesion, and who has later seen the cerebellum *post mortem*, can have any doubts about its influence on tone. Also the connexions of the cerebellum, briefly outlined above, bear such eloquent testimony to its connexion with equilibrium and movement that a change of opinion back to a more rational view began almost at once, and is in progress at the present time.

Two quotations will illustrate this. Samson Wright⁽⁷⁾ goes so far as to state that, in spite of the above-mentioned experiments, the cerebellum "probably guides the cerebral cortex in the carrying out of voluntary movements and plays an important part in the regulation of posture". Again, although labyrinthine reflexes are unaffected by the presence or absence of the cerebellum, Brain and Strauss⁽²⁾ write: "It is likely that the cerebellum exerts a fine controlling influence on labyrinthine

functions." Later, however, they show the confusion which exists in their minds, by stating that: "Analysis of cerebellar ataxia, in fact, lends no support to Magendie's view that the cerebellum is an organ of equilibration."

One would like to support very strongly the view that the importance of the cerebellum in the regulation of posture in the intact animal is not negated in the least by the fact that its extirpation does not affect postural reflexes as obtained in the laboratory. Experimentally the reflexes are examined singly, or in simple combinations, while in the normal body a complex combination of them, varying every instant, is algebraically summated. Nowhere in the brain stem is there any evidence that such a complicated piece of coordination and association can be carried out. Immediately this became necessary, grey matter, in the form of palaeocerebellum, was added to the brain stem with suitable connexions for the purpose; and we are, therefore, justified in stating dogmatically, until proof to the contrary is forthcoming, that though the lower level reflex arcs (brain stem) can carry out postural reflexes singly, or in pairs, or even more, the constant, ever-varying bombardment of proprioceptive impulses from all over the body of the intact animal must require the higher level reflex arcs of the cerebellum for their proper translation into motor impulses, resulting in the continuous, satisfactory orientation of the body in space.

In apparent opposition to this view is the fact that a human being with the whole of his cerebellum destroyed can, with the greatest difficulty, balance himself in the upright posture; while four-legged animals in a similar plight soon learn to balance themselves quite well. But this is no evidence that they are using the normal mechanism for equilibration; indeed, it is perfectly obvious that a standing "cerebellar" patient is not using this normal, unconscious mechanism. As his vestibulo-cerebral pathways are intact, he is acutely conscious of his position in space, and is constantly voluntarily, with more or less success, trying to correct the tendency to fall, which occurs because of the absence of the normal mechanism for equilibration. To say that the cerebellum is not concerned with equilibration because an animal can balance without it, is like saying that the stomach is not a digestive organ because a patient can continue to exist when fed through a jejunostomy opening.

To summarize in a general way modern opinions on cerebellar function we have:

1. From the viewpoint of comparative anatomy, the cerebellum has been evolved in two parts—a palaeocerebellum for equilibration, and a neocerebellum for the control of antagonists, synergists and fixators in voluntary movements.

2. From the physiological viewpoint, postural reflexes occur independently of the cerebellum, but it probably modifies muscle tone and appears to

cooperate with the cerebral cortex in the normal control of voluntary movement.

3. From the viewpoint of clinical medicine, the cerebellum is the great reflex organ for tone. Almost all signs of cerebellar disease can be explained in terms of hypotonia.

Can a logical and coordinated conception of the functions of the human cerebellum be reached from the apparent contradictions and inconsistencies of these opinions? The following is the result of an attempt to reach such a conception.

The Physics of the Muscular System.

In order to understand the function of the cerebellum, it is necessary to understand exactly how the muscular system works.¹ From a purely physical point of view, the body may be considered as a complicated combination of levers, acted on by internal forces (tensions of the various muscles), which in general oppose the action of external forces (the constant force of gravitation and other variable forces exerted by objects in the environment). The orientation of the various parts of this lever system with respect to one another at any instant (that is, the posture) must be the result of an equilibrium between the external and internal forces.

This is easy to understand with an animal in a constant posture over a period of time. Anyone will believe that the tensions of its muscles during that time must be just sufficient to oppose the tendency of external forces to change the posture. That this is equally true during movement may, however, require a little more explanation. Let us suppose that I push a book along the table. One might be tempted to jump to the conclusion that the muscles of my arm must be exerting more force than the resistance of the book to the movement. But Newton's laws of motion apply just as much to the human body as to inanimate objects. To every action there is an equal and opposite reaction, and if the book moves, there is immediately added a reaction, the mass acceleration, which exactly equals the force ($F = ma$). The harder I push, the more the acceleration and more the reaction, so throughout the movement external forces are still in equilibrium with the internal forces.

A corollary of this is the law that no muscle acts as an agonist in producing a desired movement if gravity acts for it. The fact of the matter is that no muscle can act as an agonist if gravity produces the desired movement for it. If it did develop an increase in tension, the movement would inevitably be accelerated, and the result would be a faster movement and not the desired movement at all. For example, if one adducts the arm slowly from the position of abduction, the *pectoralis major* muscle does not spring into action. Only if the arm is drawn very rapidly to the side, faster than

¹ Throughout this article reflexes such as those of respiration, vomiting, coughing *et cetera* are omitted. They do not alter the trend of the argument, and an attempt to include them would only cause confusion.

gravity alone could draw it, does the *pectoralis major* increase its tension and feel swollen and firm.

The aim of this short discussion on the physics of the muscular system has been to emphasize the fact that throughout the life of a normal person, during rest and movement, the orientation of the parts of his body, the position of every joint, is at every instant the result of an equilibrium between internal and external forces. This explains the fact that in a normal animal every muscle is functioning at all times. The muscular system always works as a whole.

Some Definitions.

1. *Posture*.—Posture has already been mentioned. It may be defined as the orientation of the parts of the body in space relative to one another and to the direction of gravity at any instant.

2. *Movement*.—Movement is change of posture.

3. *Tension-Length*.—A skeletal muscle, except when it is denervated, is possessed of two qualities, length and tension. In a normal animal, the length of the muscle is always the exact distance between its attachments, and no more. There is never any slack. Both tension and length may vary within limits independently of each other, and when they vary together they do not necessarily—in fact, rarely—do so proportionately. The combined tension and length of a muscle at any instant may be called its tension-length. The tension and length of a functioning muscle are the complete expression of its physiological activity, and are entirely due to impulses passing down its motor nerve.

4. *Tension-Length Pattern*.—It has already been stated that, in the normal animal, every muscle is functioning at all times, so that at every instant every muscle will have a particular tension-length. The sum total of these tension-lengths may be called the tension-length pattern of the muscular system at that instant. A good painting of the nude owes its special beauty to the perfect depiction of contour in so far as it is an indication of the superficial muscles as components in the tension-length pattern for the posture illustrated.

5. *Tone*.—Sherrington⁽⁵⁾ states that "the observations of the tonus of skeletal muscle in the mammal, therefore, go to show that the phenomenon is in skeletal muscle nothing more or less than postural contraction". This definition is always puzzling. One finds oneself arguing in the circle that tone is the basis of posture, and posture is the result of tone, and so on, without feeling much wiser. And on a hopeful search in the text-books for something that will clear one's ideas, the significant fact is discovered that, almost without exception, the writers either give no definition of tone at all or else quote Sherrington's definition.

Since posture at any instant is the orientation of the parts of the body in space at that instant, whether it be during rest or movement, it follows that, strictly speaking, every muscular contraction, voluntary or otherwise, must be a postural contraction, for without it the posture of the body

would not be what it is at the instant considered. If Sherrington's definition of tone is now applied, the conclusion is that every muscular contraction is a tonic contraction. Of course, this is not what Sherrington meant. He applied the word tone only to that muscular activity which is the result of postural reflexes. This aspect of the definition will be considered later.

It is my firm belief that no explanation of the functioning of the muscular system in the intact animal is of any value unless it is founded on the fundamental physiological properties of functioning muscle: tension and length. Since, in general usage, the word tone in its many shades of meaning always refers to a state rather than a change, a similar application in muscular physiology would be advantageous. It would, therefore, appear that the only logical definition of tone is as follows: the tone of a skeletal muscle at any instant is its tension-length at that instant. The tension-length pattern of the muscular system at any instant may, therefore, be called equally well the tone pattern.

6. *Muscular Contraction and Relaxation*.—The reader may be surprised that anyone should bother to define such obvious terms as muscular contraction and relaxation, but actually their definition is more difficult than that of tone.

The word contraction means shortening. In experimental physiology, in dealing with single muscles out of the body, one speaks of isotonic contraction (change of length without change of tension) and isometric contraction (change of tension without change of length), and such an application of the word is entirely satisfactory, because it has a definite meaning in terms of length and tension. In the body, however, though change in tension or change in length may occur alone, they most often occur together. The suggestion immediately arises that it would be a good idea to call increase in tension and decrease in length of a muscle, occurring separately or together, contraction; and similarly, decrease in tension and increase in length, occurring separately or together, relaxation. But what, then, are we to call the combinations increase in tension with increase in length, and decrease in tension with decrease in length, which also occur? For instance, imagine that a person, sitting with his head upright and facing forwards, nods it downwards. A hand on the sterno-mastoid muscles, near their sternal attachments, will easily feel the sudden drop in tension of these muscles at the commencement of the movement, because gravity will do it for them. Yet, since acting together they flex the head, their points of attachment must have been approximated by the movement and their length must have decreased. The reverse change, increase in tension and increase in length, has simultaneously occurred in the posterior nuchal muscles.

We are therefore confronted with the interesting discovery that the words contraction and relaxation, which have been used for so long to describe muscular action in the intact animal, have no definite meaning in terms of the basic physiological

properties of functioning muscle, namely, tension and length. There is, therefore, no alternative but to relegate them to the category of lay terms without any exact physical basis.

7. Change in Tone.—It is proposed to call a change, whatever its nature, in the tension-length of a muscle a change in tone of the muscle, and, whenever necessary, the nature of the change in terms of tension and length will have to be specifically stated.

As was shown in the discussion on the physics of the muscular system, every muscle of the body has its tension regulated at every instant, so that the external forces acting on the body in the posture which it assumes at that instant are just balanced. We can state the same fact now by saying that tone pattern is the basis of posture. The integration of simultaneous changes in tone in the muscles of the body constitute a change in the tone pattern. If this involves changes in tension only, there will be no change in posture, and the change of tone pattern will have been of the nature of a response to some change in the external forces, to counteract the change in posture it has tended to produce. If, on the other hand, the change of tone pattern involves changes in the length as well as in the tension of muscles, a change in posture or, in other words, a movement will have resulted.

The point which cannot be too much stressed is that it is impossible, from an accurate scientific standpoint, to consider movement in terms of a muscle or some muscles. Just as posture is the outward expression of the complete tone pattern at any instant, so a movement is the outward expression of a change in the tone pattern in its totality during a period of time. The muscular system functions as a whole at all times, and the objective results of its function, posture and movement can be considered only in terms of the whole and not of any part of the functioning system. The tone of a single muscle has no significance apart from its existence as an integral part of the tone pattern totality. The whole motor life of an animal, therefore, has as its basis the continual flux in the tone pattern continuum of its muscular system. An analogy may help. Consider a moving picture. The whole screen is covered at all times with what may be called a colour pattern. The patch of colour on any small area of the screen at any instant has no meaning, except in that it forms an integral part of the totality of the colour pattern at that instant. And the colour pattern flux is the physical basis underlying the depiction of the story of the film.

The preceding discussion has been conducted in an entirely abstract way, but, as Alfred North Whitehead has said: "The utmost abstractions are the true weapons with which to control our thought of concrete fact." So we shall proceed at once from the abstraction of tone pattern flux in any animal to the concrete facts of nerve centres and muscles in the human animal.

The Nervous Control of the Muscular System.

Skeletal muscular activity occurs solely in response to the reflex control of the central nervous system. Spinal reflexes play very little part in man, except after a latent period of shock following complete transverse section of the spinal cord. Postural reflexes, the lower nerve centres of which are certain brain stem nuclei, have already been shown to be dependent for their normal coordination on an intact cerebellum, and even voluntary movements, though originating in the cerebral cortex, are largely carried out indirectly through the cerebellum, only the agonists receiving impulses directly down the pyramidal tracts.

I believe that the best definition of cerebellar function is the regulation throughout rest and movement of the tone pattern of the muscular system. The organ functions as a whole, sending impulses to all muscles at all times. Its unity of function is reflected in the histological uniformity of its cortex.

The function may be considered in rest and then in movement. In both cases a postural reflex effect summates with a cortical effect, and the cerebellum is the organ responsible for the coordination of these two effects on the muscular system.

1. In rest, that is, when a posture exists unchanged over a period of time. The posture is maintained by: (a) Postural reflex effect, static reflexes excluding righting reflexes (in man it is probable that all righting of posture is dependent on the cerebral cortex). (b) Cortical effect. Very few human postures can be maintained by postural reflexes alone. Even the ability to stand upright has to be learnt during the first year of life, and therefore probably always involves cortical effort, however slight that effort may seem; and a posture such as standing with a bag in one hand is certainly maintained only by a continuous stream of cortical impulses directly down the pyramidal tracts to agonists, and indirectly through the cerebellum to antagonists, synergists and fixators, summatting with the postural reflex effect, and so keeping the muscular tension at a level which is able to balance the external forces.

2. In movement, that is, during change of posture. Again, two causes effect, through the cerebellum, the change in tone pattern: (a) Stato-kinetic reflexes are summated with the static ones operating during rest. (b) Cortical effect. In man the cerebrum appears to have almost completely usurped the power of initiating movements. It is concerned only with movements as such, and ordinarily knows nothing about individual muscles. The unit of cortical motor activity is a movement of any part of the body of whose position in space it is aware, and, in originating such movements, it sends impulses directly down the pyramidal tracts to agonists only. Now it has been shown that the tone pattern of the muscular system is a coordinated whole in equilibrium with external forces. If an agonist begins to produce a movement, the whole balance is upset, both as regards the tone pattern

itself and the relationship of the body to external forces. A change in one constituent part means a complete change in the tone pattern, and the cerebellum is the organ which regulates this. Partly in response to impulses direct from the cerebrum by the cerebro-ponto-cerebellar pathways, and partly to afferent impulses caused by the change in tone of the agonists, it effects the necessary alterations in tone in the rest of the body musculature which result in a perfectly smooth, coordinated change from one tone pattern to another.

It is now obvious that the so-called antagonists, synergists and fixators are merely the muscles involved, besides the agonists, in the change to the new tone pattern. Their changes in tone are postural changes, just as much as the postural reflexes of Sherrington. The two involve the same muscles, the same nervous centre, and act together always. They are merely two phases of the one process. It is the separation of them that has resulted in the apparent inconsistencies in the views of cerebellar function arrived at by study of different aspects of the problem.

While the cerebellum controls the tone pattern, the cerebrum learns movement patterns, and so, as the result of a perfect example of cooperation, the complicated series of motor acts of a normal person become possible.

Thus the three views of cerebellar function, (a) coordination of postural reflexes (equilibratory control of older writers), (b) control of antagonists, synergists and fixators in voluntary movement (synergic control of older writers), (c) reflex maintenance of tone (physicians' view), are all included in the single function of regulation throughout rest and movement of the tone pattern of the muscular system.

The *corpus striatum* must be mentioned in a discussion of the nervous control of the muscular system. It is quite certain that it assists in some way in tone pattern control, but it is equally certain that at present the exact nature of this function is unknown. Whatever it may prove to be, it seems unlikely that it will materially alter our conception of cerebellar function.

The Metabolism of the Functioning Muscles.

So far as an individual muscle is concerned, it does nothing but respond to the nerve impulses coming to it down the final common path (lower motor neurone), quite irrespective of whether they are the result of a spinal, brain stem or cerebellar reflex, or of voluntary impulses down the pyramidal tracts, or of any combination of these. If the impulses arrive at a constant rate, the muscle response is the maintenance of an unchanging tone. Such a muscle is what physiologists call a posturing muscle, though, of course, a muscle changing its tone is, strictly speaking, just as much a posturing muscle.

Physiologists, impressed with the peculiar properties of posturing muscle in decerebrate animals, made the mistake of thinking that, because

a muscle maintaining a constant tone had a low metabolism and did not become fatigued, and a muscle changing its tone had a high metabolism and did become fatigued, there must be two separate muscular mechanisms. To account for the supposed dual nature of muscular activity—plastic and contractile—various arguments ensued about red fibres and pale fibres, sarcoplasm and fibrillæ, sympathetic and somatic nerve supply, two types of metabolism involving different chemical processes. Later work has shown that all these theories are almost certainly wrong. The mechanism responsible for maintenance of tone is the same as that for changing tone.

Experiments with muscles outside the body show that the metabolism in isometric and isotonic twitches is high, but that the extra energy necessary to maintain the contraction for some time is comparatively small and, of course, depends on the tension and the time for which it is maintained. Now the tension maintained by posturing muscles in a decerebrate animal is comparatively low. For instance, the maximum tension which the quadriceps of the cat will develop as the result of a tetanizing current is of the order of 30 kilograms, and the tension developed by this muscle during the stretch reflex is about three to six kilograms (Samson Wright⁽⁷⁾). I am unaware whether it has been shown that the metabolism of a muscle maintaining tone within a decerebrate animal is the same as or different from that of a similar muscle maintaining a similar state of length and tension outside the body as the result of artificial stimulation; but it is probable that they are the same, and that, if the conditions as regards nutrition and asynchronous action of motor units could be imitated, the muscle outside the body would probably be just as unfatigable.

Similarly, if in the body voluntary impulses are added to those of postural reflexes to maintain a posture, the muscles concerned during the time their tone remains unaltered probably have the same low metabolism (except for the increase due to the increase in tension that the cortical impulses have produced) as if their activity were entirely due to subcortical impulses. If the increase in tension due to the voluntary impulses is very great, especially if sufficient to cause significant compression of the blood vessels within the muscles, they may become fatigued (for example, when one tries to hold a heavy weight in the outstretched hand well away from the body). There is another type of fatigue, however, which may occur when tone is maintained partly by voluntary impulses. When the increase in tension due to the cortical impulses is slight, there is very little greater tendency for the muscles themselves to become fatigued, even after a long time; but the cerebral cortex soon tires. It hates monotony. The focus of attention wanders and the muscular tension wanes, and only a great effort of concentration will prevent this. For example, the posture to be maintained in various endurance tests, such as pole-sitting, which

certain misguided persons undergo, necessitates a continuous small voluntary effort, and the subject finally collapses from nervous, not muscular, exhaustion.

The cerebellum, however, functions as a whole continuously throughout the life of the individual. It never fatigues. It controls all muscles at all times, for it is the nervous mechanism behind the tone pattern totality.

Just as the metabolism of isotonic and isometric twitches in the muscles outside the body is high, so also is that of muscles changing their tone within the body. If the changes in tone are frequent and great, muscular fatigue is liable to occur, but only because the metabolism is so great that phosphagen and glycogen stores are depleted and lactic acid is able to accumulate (the physico-chemical cause of muscular fatigue is not yet fully understood). It is not because there is a muscular mechanism different from that at work in "posturing" muscle. Moreover, the metabolism of a muscle changing its tone has no peculiarities dependent on the centre, cerebral or cerebellar, which produced the change.

Only one other fact has to be mentioned to show that there is no qualitative difference between the response of muscles in postural reflexes and voluntary effort. The fibres of a posturing muscle in a decerebrate animal all obey the "all or none" law, and since the tension is only about one-tenth of the total of which the muscle is capable, only about one-tenth of the muscle fibres can be in action at any time. It has therefore been suggested, and as far as is known at present, quite correctly, that groups of muscle fibres ("motor units") are contracting in rotation, and that, therefore, the muscle as a whole does not become fatigued. But recent work on the electrical changes in motor nerves has shown that voluntary muscular action is caused by asynchronous volleys of nerve impulses, so that it is also the result of quantal as well as wave summation. There would therefore seem to be no reason in favour of Sherrington's restriction of the word tone to that muscular activity which is the result of postural reflexes.

The postural reflex effect cannot be evaluated except in decerebrate or mid-brain preparations in which cortical control is absent. Hence the word tone, defined in this way, has no logical application in the intact animal, and is likewise without significance in clinical medicine. Furthermore, phenomena such as the lengthening and shortening reactions which are usually regarded as properties of "posturing" muscle, are really properties of postural reflexes. The transference of the epithet postural from reflexes to muscles has aggravated the confusion and is indeed largely responsible for the futile search for the basis of postural activity in the muscles themselves instead of in the nervous system.

It is interesting to note that in his earlier writings even Sherrington himself did not insist on any essential difference between posture and movement. In 1906⁽⁴⁾ he wrote:

The distinction between reflexes of attitude and reflexes of movement is not in all cases sharp and abrupt. Between a short lasting attitude and a slowly progressing movement the difference is hardly more than one of degree.

Some Applications to Cerebellar Disease.

The only strict localization of function which has been conclusively proved in the cerebellar cortex is that each half controls the muscles on its own side of the body. Any further localization in terms of muscles in each half is doubtful. A cerebellar lesion, if large enough to produce signs of dysfunction at all, does so on the whole of the side of the body concerned.

Small stationary lesions of the cerebellum, especially in young people, can probably be compensated for by the remainder of that organ.

From the definition of cerebellar function proposed, the signs of cerebellar disease must be the result of improper regulation of the tone pattern during rest and movement. The muscles, deprived partially or completely of impulses from the cerebellum, tend to be always in a state of less tension, and possibly also greater length, than they would be with the body in the same posture under normal conditions. They will therefore be softer to the touch than normal, and this is what is understood by the clinical term hypotonia. Hence, just as normal tone pattern is the basis of normal posture, so abnormal tone pattern from deficient cerebellar function is the basis of the clinical picture of hypotonia. It is now obvious that the definition of tone given above corresponds exactly with the clinical meaning of the term.

A detailed explanation of the signs of cerebellar dysfunction in terms of hypotonia is given by Brain and Strauss,⁽²⁾ and there is no point in paraphrasing it here. A few only of the more interesting signs will be treated briefly. Suppose a "cerebellar" patient desires to perform a voluntary movement. From his cerebral cortex a normal series of nerve impulses pass to the agonists and to the cerebellum. Proprioceptive impulses from the agonists, caused by their change in tone, also reach the cerebellum, but in response, either nothing happens or a most inadequate series of motor impulses are emitted from it, and the proper changes in tone pattern are not carried out. The agonists therefore produce movements which would not have occurred in normal circumstances (ataxia). Their action is also weak (asthenia).

This is due to several factors:

1. The voluntary impulses are normal, that is, only such as would result in the agonists performing the desired movement with the aid of the proper tone pattern regulation by the cerebellum. Without this aid the tension development is inadequate.

2. Voluntary impulses, instead of summing at the final common path with cerebellar impulses which were keeping the agonists in a normal state of tone at the instant the voluntary movement started, have to cause the change in tone of the agonists from a very low initial tension.

3. The diminution or lack of normal cerebello-cortical impulses no doubt interferes with the function of the cerebral motor cortex.

The cerebral cortex, which is very adaptable, soon begins to get more or less used to the abnormal state of affairs, and attempts to correct the asthenia by sending more impulses to the agonists than would be normally required. Such attempts at correction result in great irregularity in the tension development (dysmetria). Often the slow, irregular start of a movement is followed by the limb being suddenly flung towards the goal, when cortical impulses are sent to try to correct the weak start. As time goes on, however, the cerebrum becomes more proficient at managing the agonists without cerebellar aid, and the various signs of cerebellar disease become less marked. This is not due to the cerebrum partially acquiring cerebellar function, as is sometimes stated. The cerebrum never in any circumstances regulates the tone pattern. Its impulses pass only to agonists of movements, and no other muscles.

Summary.

1. The apparent inconsistencies in modern views on cerebellar function arrived at by the study of different aspects of the problem are indicated.

2. The belief that no explanation of the physiology of the muscular system is of any value unless founded on the fundamental physiological properties of functioning muscle, tension and length, is stated.

3. A new definition of tone is proposed, in terms of tension and length, which abolishes the artificial separation of muscular activity into that due to postural reflexes and that occurring in voluntary movements.

4. A definition of cerebellar function in terms of the new definition of tone is given, and is shown to remove all the apparent inconsistencies in modern views.

5. The abolition of the artificial separation of muscular activity into two types is justified by showing that the available evidence indicates no qualitative difference in the muscular mechanism employed as regards metabolism, fatigue, or even the centre from which the nerve impulses giving rise to the activity come.

6. Some applications to cerebellar disease are mentioned.

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Reports of Cases.

RAT-BITE FEVER.

By B. T. SHALLARD, M.D. (Melbourne),
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District Hospital.

IN THE MEDICAL JOURNAL OF AUSTRALIA, October 24, 1936, appeared an article by Derrick and Brown,¹¹ in which it was stated that only three cases of rat-bite fever had been reported in Australia. The following history is recorded of a probable case of rat-bite fever in a child.

History.

On October 26, 1936, R.B., a boy, aged ten years, came under notice with the history that on October 10, 1936, while attempting to catch a rat, he was bitten on the right hand. The wounds inflicted rapidly healed; but two days before he came under observation the region had become slightly painful and swollen.

On examination three small scars were apparent, some 2·5 centimetres apart, on the dorsum of the right hand, near the metacarpo-phalangeal joints. Midway between them was a pale red, slightly tender and firm nodule the size of a sixpenny piece.

On October 28 the patient became ill, with malaise, anorexia, mild headache and fever. On November 1 these symptoms were accentuated, his temperature reaching 39·4° C. (103° F.). The swelling on the hand now involved the whole dorsum; the palm and the middle and ring fingers were swollen. The mass was dull red in colour, and firm and brawny to palpation. The right epitrochlear and axillary glands were very painful; they were swollen and tender and felt somewhat matted.

On November 2 the maximum temperature was 37·2° C. (99° F.) and the pulse rate 100 per minute. For the next two days the patient was afebrile, the local lesion showing some abatement; but the glandular enlargement remained.

Fever recurred on November 5, reaching 39·8° C. (103·6° F.). It was accompanied by anorexia, nausea, headache, furred tongue, tachycardia (pulse rate 120 per minute), pain in both groins, and pain and tenderness in the splenic region. The spleen was impalpable. The hand was less swollen. Lymphangitis was noted extending from the right hand to the elbow. The next day the temperature was normal. The patient remained well until November 10, when fever of 40·5° C. (105° F.) recurred, with accompanying symptoms, and he appeared very ill. The next day the fever had gone; the swelling of the hand had subsided still more, and the tip of the spleen had become palpable. The boy was feeling well and was out of bed. The regional lymphatic glands remained swollen and tender.

He was given 0·15 grammes of "Novarsenobillon" intravenously on November 12, and 0·3 grammes a week later. There was a mild arsenobenzene reaction a few hours after the second injection, taking the form of a rigor with headache, vomiting and fever.

The enlargement of the spleen and lymphatic glands disappeared within forty-eight hours of the first injection; there was no recurrence of fever, and there were no further symptoms. No cutaneous eruption was seen at any time, and there was no ulceration of the lesion on the hand.

Blood taken on November 4 and 12 did not react to the Wassermann test.

Dr. W. C. Sawers, of the School of Public Health and Tropical Medicine, the University of Sydney, to whom I am indebted, inoculated white mice and guinea-pigs with defibrinated blood from the patient. Injections of up to one cubic centimetre of blood were made intraperitoneally. The blood used was taken on November 4 and 5. This was early in the illness, on the day preceding a relapse and on the day of a relapse. The blood of these animals

was microscopically examined by dark-ground technique daily. On the tenth day, one of the mice was killed and its peritoneal fluid was examined. These examinations did not reveal any organisms.

Comment.

A case is reported which is considered to be one of rat-bite fever. The diagnosis rests entirely on clinical grounds and on the response to specific treatment, no supporting evidence being available from special tests.

Difficulty in isolation of the causative organism, the *Spirillum minus*, is by no means unusual in these cases. Bayne-Jones¹⁰ was able to recover it in but five of seventy-five cases which he "considered genuine".

Many animals, including cats, weasels, dogs, ferrets and squirrels, are capable of transmitting the disease. The incubation period may be long—two to six weeks—and the incident of a bite may be forgotten. Derrick and Brown¹¹ say "it is possible that cases of rat-bite fever go unrecognized".

Diagnosis of this disease, with its recurrent pyrexia, splenomegaly, and local glandular enlargement, will often be made late in the course of the disease, even when a history of a bite is not obtained. In any prolonged intermittent pyrexia rat-bite fever should be suspected. Blood should be taken from a vein and inoculated intraperitoneally into a white mouse in such cases. The therapeutic test of cessation of relapses after the intravenous administration of arsenic is also of value.

Acknowledgement.

I am grateful to Dr. W. C. Sawers for his interest in carrying out the pathological work outlined.

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¹⁰ E. H. Derrick and H. E. Brown: "Rat-Bite Fever: Some Observations", THE MEDICAL JOURNAL OF AUSTRALIA, October 24, 1936, page 553.

¹¹ S. Bayne-Jones: "Rat-Bite Fever in the United States", International Clinics, Volume III, September, 1931, page 235.

HERNIA THROUGH THE FORAMEN OF WINSLOW.

By R. S. DAY,
Resident Medical Officer, Hobart Public Hospital,
Tasmania.

THE patient was a married woman, aged thirty-nine years. Two days prior to admission to hospital she developed acute colicky pain in the epigastrium and the whole of the left side of the abdomen. Pain occurred at intervals of about three minutes and was likened by the patient to labour pains. The following day the abdomen became distended and she began to vomit frequently. This afforded her no relief. Up to the time of her admission the pains became more severe and vomiting became more frequent. During this time the bowels were opened regularly. There were no urinary symptoms.

On admission, the patient was obviously very ill, with all the marks of dehydration. The signs pointed to an obstructive intestinal lesion; the abdomen was very distended and tympanitic; there was no definite dulness in the flanks and there were no signs of shifting dulness. No tumour was palpable. Enemata failed to relieve the condition, and she was prepared for operation.

Laparotomy through a paramedian incision revealed marked distension of the small bowel. There was no sign of the caecum in the right iliac fossa. Investigation revealed the presence of a very large caecum with several inches of both the ascending colon and the lower part of the ileum herniated through the foramen of Winslow into the lesser sac of peritoneum. Extraction was accomplished without difficulty, and, as the bowel was viable, the caecum was fixed to the right iliac fossa with a few sutures.

The patient progressed without complication, but died of pulmonary embolism fifteen days after operation.

The case is reported not only because of the rarity of lesser sac hernia, but because of the additional rarity of a mobile caecum being part of the hernial content.

Acknowledgement.

I am indebted to Dr. J. F. Gaha, honorary surgeon, for permission to publish this case.

AN OPEN SAFETY PIN IN A CHILD'S TRACHEA FOR EIGHTEEN MONTHS.

By E. A. MATISON, M.D.

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Children's Hospital, Adelaide.

THE following is the report of a case in which an open safety pin was in a child's throat for eighteen months.

C.W., aged three years, was admitted to the medical department of the Adelaide Children's Hospital on February 3, 1937, with a history of an attack of "influenza" eighteen months previously.

Since then the child had developed intense hoarseness and repeated attacks of respiratory distress, which were gradually getting worse. The attacks were intermittent and lasted as long as one week. The mother described the attacks as asthmatic in type.

Dr. Le Messurier asked me to see the child in consultation. During a routine X ray examination an open safety pin was shown to occupy the upper part of the trachea. Under "Avetin" a bronchoscopy was performed and an open safety pin was seen, the point of which was found deeply embedded for about half an inch in the subglottic tissue. The pin was extracted with very little difficulty, the Chevalier Jackson technique of shielding the point of the pin by the lip of the bronchoscope being employed.

The child made an uneventful recovery and showed rapid improvement in the quality of the voice.

Reviews.

OBSTETRICS.

"A GLASGOW MANUAL OF OBSTETRICS" has been written by four writers in collaboration.¹ The eminence of the names on the title page is sufficient to justify their claim that they have included in the manual all the advances made in obstetrics during the fourteen years that have elapsed since the publication of the first edition in 1924.

The writers are members of one unit in the largest maternity hospital in Britain, where, owing to the prevalence of rickets in Glasgow, more serious complications of labour are met with than in any other city. Glasgow has long been the field of operation of many famous obstetricians, and sufficient original research work in obstetrics has been done, and still is being done, there to constitute a definite Glasgow school of obstetrics.

We welcome this text-book for students and aid to practitioners from such prominent and well qualified teachers and practitioners at a time when there is a growing feeling of dissatisfaction with the practice and results of obstetrics. The past years have not resulted in any great improvement in the general practice of mid-

¹ "A Glasgow Manual of Obstetrics", by Samuel J. Cameron, M.B., F.R.F.P.S., F.C.O.G., John Hewitt, M.B., Ch.B., F.C.O.G., Robert A. Lennie, M.D., F.R.F.P.S., F.C.O.G., Ellen D. Morton, M.B., Ch.B., M.C.O.G.; Second Edition; 1936. London: Edward Arnold and Company. Medium 8vo, pp. 619, with illustrations. Price: 21s. net.

wifery. But nevertheless these have been years of pains-taking research and earnest endeavour on the part of obstetricians to make easier and safer the prime duty of women to the race. Perhaps the failures of the past have been partly due to the rebellion of our women against the suffering and sacrifice such fulfilment entails, and to their demand for easy and painless labour. Obstetricians have been too complaisant, and have met the demand by the over-use of anaesthetics, forceps and Cesarean section. The manual is a stimulus to better obstetric practice.

The chapter dealing with puerperal sepsis covers the whole field of recent research in this direction from the points of view of causation, prevention and treatment. Stress is laid on the association of haemolytic streptococci of human origin (Group A of Lancefield's classification) with the greatest percentage of severe and fatal cases, and on the comparative rarity of other types in severe cases. The inevitable deduction, that the majority of cases of puerperal sepsis are due to "droplet" infection, is followed by the serious admonition that all persons in attendance, both at the confinement and during the puerperium, must be masked, and must not even "chatter" unnecessarily.

The comparative failure of special methods of treatment in established cases is emphasized, and the corollary is drawn that improvement in results in obstetrical practice must come from preventive methods. The complacent or impatient obstetrician who is willing to take risks, the pliable seeker after a reputation among his patients for "kindness", and the practitioner whose only treatment for a refractory patient is the application of forceps, will no longer be able to salve their consciences by blaming the patient's lack of natural resistance after reading that this is now a declared theory, but that puerperal sepsis is due to the virulence of the infecting organism, which, in nearly every instance, is introduced at the time of labour.

Cesarean section—that easy way out of difficulties—is fully dealt with, and its indications are strictly defined. The classical and the lower segment operations are compared with a bias in favour of the older operation. The high mortality rate following this operation in septic cases is stressed and alternative methods are fully discussed.

The chapter on sex and reproductive hormones goes a long way towards clarifying the present-day position of our knowledge of this subject. The therapeutic uses of these hormones are now more clearly indicated in dysfunctions of menstruation and pregnancy. For instance, the treatment of threatened abortion by corpus luteum, thyreoid and anterior pituitary hormones follows from the account of the influence of these hormones on pregnancy.

The manual concludes with chapters dealing fully with feeding of the new-born child, the premature child, birth injuries and accidents, diseases of the new-born child *et cetera*.

GASTRO-DUODENAL DISEASE.

THE Mayo Clinic has produced a very full and instructive contribution under the title of "The Stomach and Duodenum".¹ It is written by members of the staff of the Mayo Clinic, and fully embraces the knowledge which has been gleaned in regard to the medical and surgical aspects of gastro-duodenal diseases. In the 900 odd pages, liberally interspersed among which are 436 illustrations, George B. Eusterman and Donald C. Balfour, both well known in the field of medicine and surgery respectively, have provided a work comprehensive and well balanced, with a clinical application of benefit alike of general practitioner and specialist.

It is a volume wherein the reader can follow for himself the modern advance which has occurred in the knowledge of gastro-duodenal diseases. Chapters on the physiology, experimental work, *post mortem* tabulations, biological

chemistry, radiology and symptomatic interpretations, all lead us up to the consideration of the diagnosis.

There is little or no superfluity of data. Having arrived at the diagnosis, the authors proceed on a practical plan to deal with the patient and the lesion. There is consideration for medical and surgical aspects, and in this regard a very useful chapter on modern anaesthesia for these patients is included. In the surgery of the stomach and duodenum it is worth mentioning that Balfour, that doyen of stomach surgery, has contributed largely in presenting modern surgical treatment. The chapters dealing with this aspect of the subject are very well written and thorough. The surgical treatment of ulcer and carcinoma are discussed and the recommendations of the different operations are substantiated by results obtained clinically and supported by experimental work on animals. One is left, however, with the feeling that in carcinoma heroic operations can be performed with an end result little better than that which a simpler operation would have provided, at any rate to make the patient comfortable.

There is in passing no mention of the histidine treatment of ulcer, but the authors in their foreword state that they have incorporated only what has been tried.

This book is easy to read and understand; it represents a record of the present-day knowledge of the stomach and duodenum, put forward not by an unrelated group of workers in the field of gastro-duodenal diseases, but by a group working in unison on the subject.

The complexity of the subject is excellently handled and coordinated in such a way as to interest all practitioners.

EXERCISES FOR WOMEN.

MARGARET MORRIS has published an interesting description of her physical training methods under the title of "Maternity and Post-Operative Exercises".²

The title is somewhat misleading, as the majority of the exercises could be used with advantage by all women, especially growing girls. There is an excellent chapter on breathing and posture, which would give valuable hints to all those interested in the physical training of the future mothers of our race.

The book is intended primarily for masseuses and midwives to use under medical direction, but it is doubtful whether many nurses would take the trouble to teach the exercises unless they received higher pay for maternity cases than they do at present.

Most of the twenty-one exercises, which are fully described and illustrated by diagrams, are devised to teach women to train their muscles to function effectively in childbirth. Others are to help them preserve their health and regain their figures in the puerperium. The exercises are arranged in groups, and the uses and desired effects of each group are fully described. To get the full benefit of the training, the exercises should be performed under the direction of a competent instructor.

The book should be of interest to nurses, general practitioners and those who specialize in the diseases of women. Doctors and nurses could certainly show their patients how to perform the simpler exercises, and if the women were interested they could study the system themselves. If women paid more attention to the development of their muscles, they would do much to counteract the disfigurements and disabilities that often follow childbirth. These exercises would also give women of the leisure class an interest during the ante-natal period, when they are apt to lie about and sigh for the day of deliverance from the weariness of the flesh. These same women would also find that the march of time would be more effectively repelled by Margaret Morris exercises, supervised by a competent masseuse, than by elaborate coiffures and expensive corsets. The book is well arranged, clearly printed and easy to read.

¹ "The Stomach and Duodenum", by G. B. Eusterman, M.D., F.A.C.P., and D. C. Balfour, M.B., M.D., LLD., F.A.C.S., F.R.A.C.S.; 1935. Philadelphia: W. B. Saunders Company; Melbourne: W. Ramsay. Royal 8vo, pp. 973, with 436 illustrations. Price: 63s. net.

² "Maternity and Post-Operative Exercises in Diagrams and Words", by M. Morris, C.S.M.M.G., in collaboration with M. Randell, S.R.N., S.C.M., T.M.M.G.; 1936. London: William Heinemann (Medical Books) Limited. Demy 8vo, pp. 168, with illustrations. Price: 7s. 6d. net.

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ACCIDENTS AND THE HUMAN FACTOR.

In May, 1935, reference was made in these columns to the appalling number of deaths that occur in Australia every year as a result of motor traffic accidents. It was pointed out that, in addition to causing death, motor traffic accidents brought in their train suffering that was unnecessary, and disability that was often permanent. The view was expressed that no appreciable reduction could be brought about unless definite data were available. To this end a plea was made for the establishment of a Motor Accident Investigation Board that would determine the cause of each accident and accumulate material on which legislative action might be taken. Reference was also made to what is known as accident proneness, and to the view of the Industrial Research Board of the Medical Research Council that accident proneness is subject to definite laws. Accident proneness is not manifested in motor car driving alone; industrial undertakings of all kinds will, if trouble is taken to find them, furnish examples of this unfortunate proclivity.

With the mechanization of industry attention was given to the avoidance of accidents; guards were placed at all points of machinery that were a likely source of danger to attendant workers; and accidents due to unguarded machinery are seldom seen. H. M. Vernon, well known the world over as an authority on industrial hygiene, has recently pointed out that at the present time the majority of accidents incurred in most branches of industry are not connected with machinery at all.¹ In his opinion they depend on non-mechanical conditions in which the human factor plays an all-important part. This human factor, he states, may consist in accident proneness ("the special liability of certain individuals to incur accidents"), it may be due to want of attention to the work in hand, it may be due to actual carelessness, it may depend on lack of knowledge of the dangers incident to an occupation and of the methods of avoiding them. "In order to reduce accident frequency, it follows that these and other elements dependent on the human factor need special study, and the appropriate application of the knowledge so obtained"—a conclusion almost identical with that stated in this journal two years ago. Vernon holds that whatever progress has been made in accident prevention on the theoretical side, progress on the practical side has been comparatively slight as far as Great Britain is concerned. He can find no evidence that better progress has been made in other industrial countries. Unfortunately there is no psychological test by which accident-prone persons can be identified before they are assigned to their occupations. The Industrial Research Board of the Medical Research Council holds that accident proneness is a relatively stable quality; and Vernon points out that it is seldom due to lack of a single quality. He adds that it may be due to slowness in making simple muscular movements, to poor neuro-muscular coordination, to lack of intelligence, to temperamental unsuitability to the task in hand, and to other defects in varying degrees. At the present time accident proneness can be discovered only by the simple method of trial and error—the actual performance at an

¹ International Labour Review, December, 1936.

occupation must be taken as an index of accident proneness. Since accident proneness is a stable quality, we must agree with Vernon that it is well to be on the safe side and to transfer accident-prone persons to occupations in which they can do very little harm to themselves or to others. Among those who are not accident-prone, reliance must be placed on what is known as the safety-first movement. The object should be the development of semi-automatic habits of safety. Though a great deal may be done in this way, it is well nigh impossible to prevent the human mind from wandering, and some accidents due to lack of attention will probably always occur. Vernon points out that more use might be made of the National Safety First Association in Great Britain. Only one in every five firms with over a thousand employees belongs to the association; of firms having twenty-six to a thousand employees, one in two hundred is a member; of small firms having twenty-five employees or less, only one in six thousand is a member. Vernon points out that in Great Britain and in America the instruction of school children in road safety and in other forms of accident prevention has yielded striking results. He is justified in his contention that habits formed in childhood will persist when the child enters industrial employment. Most of the risks of industry are quite different from those encountered in childhood, and for this reason systematic instruction in industrial risks should be continued for the first few years of industrial life. In Great Britain one and a half hours' instruction is given every week to juveniles in the coal-mining industry; nothing of the kind is attempted in factories. Even if all these things are done, some accidents will doubtless still occur; these should be studied by some such body as was advocated by this journal in connexion with motor traffic accidents. The difficulty is to persuade those in authority that something should be done; the effort would not be spectacular, and no immediate financial outcome would be apparent. In this matter, as in many others, industrial hygienists must be like the importunate widow of the Gospel who was at length avenged by the judge, "lest by her continual coming", as he said, "she weary me".

Current Comment.

DISSECTING ANEURYSM OF THE AORTA.

THE uncommon but serious vascular accident known as dissecting aneurysm of the aorta has received increasing attention in recent medical literature, mainly as a result of the search for a reliable clinical syndrome which would permit of an *ante mortem* diagnosis. Robert Earl Glenly, Benjamin Castleman, and Paul D. White have collected clinical and *post mortem* notes of nineteen instances of the lesion from the records of the Massachusetts General Hospital.¹ The affection is one that is usually, but not always, rapidly fatal. There is little time for careful case-taking therefore, or, more likely, the patient is too ill to be disturbed for this purpose. The rarity of a correct diagnosis during life was displayed by Shennan, who contributed a monograph on this subject in 1934 (see THE MEDICAL JOURNAL OF AUSTRALIA, April 21, 1934, page 533). He considered that a correct *ante mortem* diagnosis had been made in only six patients among 300 with dissecting aneurysms of all types, including 17 patients of his own. The patients are usually regarded as suffering from acute coronary occlusion or even from some abdominal emergency. The authors state that in all eighteen instances are known in which the condition has been recognized before death.

The actual frequency of acute dissecting aneurysm in this series was approximately 1 in 630 autopsies on persons of all ages. All the aneurysms occurred in persons over forty years of age, with one exception, a man of twenty-nine with rheumatic endocarditis. There was a distinct preponderance of males over females. Of the symptoms and signs noted, one of the most striking was the very sudden onset, especially of pain, and in five patients just after some physical or emotional effort. The site of onset of the pain appears to be most variable, also its direction of radiation. Pain may extend practically anywhere between the mastoid process and the thighs, except into the arms, and may be as severe in the back as in the front of the body. The pain was for the most part severe and stabbing, and in 11 out of the 13 patients it was constant from its inception until death occurred. Dyspnoea was almost always noted. Prostration and shock are extreme, leading even to loss of consciousness. The blood pressure may nevertheless be maintained at a high level. Hypertension indeed is almost invariably present, usually beforehand, of course, but one patient was observed in whom the blood pressure rose to from 140 to 220 millimetres of mercury during the course of the illness, the diastolic pressure remaining unaffected. Tachycardia was often absent, heart sounds were often of good quality, and cardiac murmurs were common as a result of antecedent valvular sclerosis. The murmurs were

¹ American Heart Journal, February, 1937.

sometimes observed to have changed in character as a result of distortion of the aortic ring. Vocal hoarseness was apparent in two patients with haemorrhage into the mediastinum. The same two patients also showed signs in the lungs which were interpreted as those of consolidation. A low grade fever was present in all patients who survived the accident for a few days. The average survival period of 10 of the 13 patients was four days. Another lived for 105 days.

In half the acute cases death followed rupture into the mediastinum. In four instances intrapericardial rupture took place. Rerupture into the aorta was observed only twice. An average leucocytosis of 20,000 cells per cubic millimetre was a common finding. The blood, when subjected to the Wassermann test, consistently failed to yield a reaction. Syphilis has no part in the aetiology of this affection. The cardiogram is not characteristic. X ray examination may reveal darkening of the posterior mediastinum. On examination of the aorta after death a transverse, irregular tear about two centimetres in length appears just above the aortic valve. The dissection lies almost always between the middle and outer thirds of the media, and involves one-half or two-thirds of the circumference of the vessel and may extend as far distally as the iliac arteries, splitting up some of the main branches *en passant*.

It has usually been assumed that most examples of dissecting aneurysm begin at an atheromatous ulcer. The evidence of this series would oppose such a view, as the majority began at the commencement of the aorta, where ulceration is least prominent. In the few instances in which an ulcer appeared to be the starting point, the aneurysms were in the descending aorta, were short and non-fatal. Aortitis may weaken the intima sufficiently to favour a tear, but the present authors would ascribe a more important rôle to affections of the nutrient arteries of the aorta, or *vasa vasorum*. Closely allied to this idea is the real underlying fault, namely, the spontaneous appearance in life of splits or holes in the media, called "medial cystic necrosis", resulting from mucoid or hyaline degeneration, ascribed for want of a better name to "senile change". Shennan believes that the origin of the tear so close to the aortic ring is the effect of diastolic recoil, causing a vertical stretching of the ascending aorta.

While no treatment beyond absolute rest is likely to be of any assistance, clinical interest centres around the value of a correct opinion from the viewpoint of prognosis. The most frequently confused affections are arterial embolism, pneumonia, a surgical abdominal emergency, and, most commonly, coronary thrombosis. Consideration of the following facts would seem to help towards a true elucidation of a doubtful case. *Angina pectoris* precedes coronary occlusion much more commonly than dissecting aneurysm; the sudden and overwhelming nature of the pain differs from the more gradual onset of cardiac infarction. Hypertension persists

in dissecting aneurysm, and signs of peripheral arterial obstruction are early in appearance. Most helpful is the evidence of coronary occlusion afforded by daily cardiograms. From the practical aspect, one of the most valuable points revealed by this contribution, which is most carefully compiled, is that one of every four sufferers from coronary occlusion dies in the attack, whereas only one person with a dissecting aneurysm survives.

HÆMORRHAGE OF THE LIVER IN THE NEW-BORN.

THE recent discovery of subcapsular haemorrhage of the liver at autopsy on an infant three days old has led a reader of this journal to ask for information on the subject and for references to the literature. The subject has seemed of sufficient importance to justify its mention in these columns. Writing in *The American Journal of Surgery*, Volume XXIV, 1934, at page 373, J. H. Taylor quotes F. C. Wood as stating that the only hemorrhages of the liver that he had seen had been traumatic. He also refers to Gerlach, who held that it was possible that trauma would produce no damage of the parietal walls of the abdomen and that the haemorrhage might remain entirely beneath the liver capsule or deep in the liver substance. Livers damaged in this way are found chiefly in new-born children. The condition has been described as the lower abdominal apoplexy of the new-born, and, Taylor states, was described by Kiwisch in 1841. He adds that some writers believe that the condition does not occur in a normal labour. Kiwisch thought that it was due to the early tying-off of the cord. Taylor also refers to Birch-Hirschfeld's view that it was the result of prolonged slow labour and disproportion between the sizes of the passages and the child, causing pressure of the ribs on the liver and crushing of that organ. Fahr thought that chemical changes of the blood in asphyxia might be responsible, the walls of the small vessels being damaged by excess of carbon dioxide. Vigorous artificial respiration might, of course, damage the liver. Ewing has laid emphasis on trauma as a cause of liver haemorrhage. That liver haemorrhage can occur after spontaneous delivery has been shown by Gymnich, who contributed an article on the subject to *Monatsschrift für Geburtshilfe und Gynäkologie* in May, 1932. A short abstract of this article was published in our issue of December 3, 1932. Gymnich reviewed from the literature nine cases in which spontaneous delivery was accompanied by liver injury, and reported a case of his own. He recorded subcapsular haemorrhages and also rupture of the capsule. He found that death occurred a few days after delivery, and thought that the injury was caused by pressure of the ribs on the liver. Gymnich, at the end of his article, gives references to seven publications—German and Scandinavian. It is interesting to note that he suggested episiotomy as a prophylactic measure when, after delivery of the head of the foetus, birth of the body would seem to be difficult.

Abstracts from Current Medical Literature.

RADIOLOGY.

Porphyriæmia and Porphyriuria.
I. S. TRÖSTLER (*Radiology*, October, 1936) calls the attention of radiologists to the fact that haematoxophyrin and also many commonly used sedatives, such as "Sulphonal", "Luminal" and other barbituric acid derivatives, produce porphyriæmia and porphyriuria. These conditions cause the tissues to become highly sensitive to light and irradiation, and, unless this is borne in mind, some radiologists may have reason to wonder why erythema appears after moderate or even mild dosage.

Dilatation of the Pelvic and Juxtavesicular Portions of the Ureters.

JOHN HELLSTROM (*Acta Radiologica*, January, 1937) states that in excretory urography one not infrequently finds a dilatation of the pelvic and juxtavesicular portions of the ureters while the upper ureteral segments are not at all or only slightly dilated. In the literature this juxtavesicular ureteral dilatation has been described, especially in prostatic hypertrophy and in inflammatory diseases of the adnexa. According to the investigations of the author it is particularly typical of uterocele, is common in hypertrophy of the prostate, but is less usual in prostatitis. Possibly there also exists a congenital juxtavesicular ureteral dilatation. As a rule the cause of the dilatation would seem to be difficult ureteral emptying. In prostatic hypertrophy especially there are different conceivable possibilities. The juxtavesicular ureteral dilatation may be regarded as a compensatory phenomenon calculated to increase the functioning capacity of the ureter and to hinder dilatation of the upper ureteral segment and renal pelvis.

Bone Changes in Chronic Fluorine Intoxication.

PAUL A. BISHOP (*American Journal of Roentgenology and Radium Therapy*, May, 1936) states that workers are exposed to the risk of chronic fluorine intoxication in the manufacture of superphosphate fertilizers from phosphate rock, or in the refining of cryolite, an ore used extensively as a source of aluminium, alum, and caustic soda. The most evident general symptoms are mottled discolouration and pitting of tooth enamel, loss of weight, impairment of growth in young individuals, loss of appetite and cachexia. The damage done to the individual outlasts the period of exposure, and recovery is never complete. From a practical viewpoint, it appears that after the ingestion of fluorine salts, the most of which are readily soluble, a certain amount is absorbed and eventually

converted into calcium fluoride, which is practically insoluble. The chemical process and the tissues in which it occurs are not known, but, in contact with bone, calcium fluoride is deposited with other calcium salts in the bone. Being insoluble, the calcium fluoride remains and accumulates, instead of being eventually eliminated from the body as a part of the usual interchange of old and new calcium salts that takes place in normal bone metabolism. It would seem that only that part of the fluorine which is not combined with calcium is eliminated. Evidence indicates that a low calcium intake hastens the onset and development of symptoms of chronic fluorine intoxication, while a liberal calcium intake tends to offset those effects. The essential changes, seen on X ray examination, are an increase in bone density without alteration of normal bone structure, lack of normal sharpness of the bone outlines, and extension of calcification into ligamentous attachments. These features combine to give one the impression that the X ray pictures have been made with a very broad focus tube operating at too low a voltage. Repeated attempts failed to produce films with satisfactory bone detail and density. The increase of bone density varies from slight blurring and accentuation of the trabeculations, "fleecy thickening of the bone laminae", in areas of early involvement, to marked homogeneous opacity, "milk white opacity" with obliteration of bone detail in the most advanced areas. The earliest changes appear in the trunk, especially in the spongy bone of the vertebrae and pelvis. As the condition progresses, the changes in these bones become more pronounced and the process extends toward the periphery, until in advanced stages the bones of the hands, feet and skull are involved. The characteristic of this increase in density is the preservation of the normal osseous architecture. There is no bone destruction and no distortion or replacement of trabeculations; the appearance is one of normal bone structure, but of too much of it. The indistinct margins are the result of extension of calcification into the soft tissues at the attachments of ligaments and muscles. This, with the increase in density, gives the impression of enlargement of the bones. This is especially true of the ribs, where the actual widening, due to the fringe of calcium deposit in the soft tissues along the ridges on the lower margins, is accentuated by the corresponding narrowing of the interspace. Osteophyte formation with calcification of the ligaments between the vertebral bodies is noticeable.

The End Results of Injuries to the Epiphyses.

OSCAR LIPSCHULZ (*Radiology*, February, 1937) has made observations on one hundred and six traumatically displaced epiphyses for a period of time ranging from sixteen months to

eight years following injury. Only a small percentage of these cases were seen less than two years after injury. This time interval is considered sufficiently long for growth disturbances to manifest themselves if they are to take place at all. In fifteen cases there was X ray evidence of premature ossification and suppression of growth. This group is made up of six radial cases in which there was retarded growth ranging from eight to sixteen millimetres; three cases in which the epiphysis for the medial epicondyle of the humerus failed to unite after separation; three cases in which there was premature ossification with shortening of the ulna; two cases which involved the proximal epiphysis of the humerus in a similar manner; and one case in which the separated epiphysis for the lesser trochanter of the femur united with deformity. In only three of these many reexamined cases was there noted a slight disturbance in function—cases of separation of the epiphysis of the medial epicondyle of the humerus in which union did not occur and which resulted in a very slight limitation of extension. In all the other cases there was no limitation of motion. In injuries about the ankle, separation of the distal epiphysis of the tibia was present in sixteen of the cases in which no reexamination was made. This injury occurred in a group of persons ten to sixteen years of age. In all but two there was an associated fracture through the adjoining shaft; in four there was an associated fracture of the distal third of the shaft of the fibula. In two of these cases there was a fracture through the epiphysis with separation of only that portion of the epiphysis involved in the fracture. In one instance there was a slight separation of the distal epiphysis of the fibula. There was no interference with growth in any of these cases. In this group of ankle injuries there was also one case of separation of the distal fibular epiphysis, with minimal fracture of the adjoining shaft, but with no other bony injuries about the ankle. Final film study in this instance revealed no evidence of disturbed growth. Five of this entire group of eighteen persons with epiphyseal separations were reexamined after complete fusion of the epiphysis with the shaft. Reexaminations were carried out in 71 cases of displaced epiphysis which involved the lower end of the radius in persons ranging from seven to seventeen years of age. In 56 of these there was an associated fracture of the adjoining diaphysis. In 36 cases there was a fracture of the styloid process of the ulna; in four others, an associated fracture of the distal third of the shaft of the ulna. In three of these cases there was a separation of the distal epiphysis of the ulna. Seventeen of these patients were observed at the time of completed growth. Radiological evidence of growth change was noted in six instances, but none of the changes

Only six cases were to cases of disturbance of growth, radial growth was sixteen times greater than the ulna after there were cases of epiphysis earlier; In disturbed radial growth, the ulna does not result, and disturbed function results only from the more pronounced growth disturbances.

PHYSICAL THERAPY.

X Ray Therapy of Hodgkin's Disease.
HAROLD W. JACOB, C. B. PEIRCE AND ROSCOE C. HILDRETH (*American Journal of Roentgenology and Radium Therapy*, August, 1936) attempt to evaluate various methods of irradiation used in 161 cases of Hodgkin's disease. They conclude that no unfavourable biological changes were observed following irradiation by any of the methods employed. X ray therapy in any degree has extended life. Systemic irradiation has been no more effectual than repeated local irradiation in prolongation of the total duration of the disease in those patients now known to have died. Systemic irradiation of all lymphoid areas is the most suitable method.

Supervoltage X Ray Therapy.

T. LEUCUTIA (*American Journal of Roentgenology and Radium Therapy*, September, 1936) analyses the results obtained from the use of extremely high voltage X rays, which he has used over a period of three years. He emphasizes that comprehensive comparative statistics of five-year cures will be necessary to justify the use of supervoltage X rays from the practical standpoint. From his own experience he concludes that this type of therapy is an important addition to the treatment armamentarium; and although it cannot be said that the general laws of radio-sensitivity, and thus of irradiation response to tumours as a whole, are influenced to any appreciable extent, nevertheless the better distribution and the creation of more advantageous absorption conditions within the tissues irradiated, help to bring about an increasing improvement of therapeutic results. Techniques are described and case histories given of patients treated for lesions in various situations. In

some instances mixed irradiation, or the use of lower voltage X rays in addition to those at 500 kilovolts, has been adopted. A woman originally suffered from a terminal cancer of the cervix, with frozen pelvis and vesico-vaginal fistula; more than two and a half years later the carcinoma was shown to be entirely healed and the fistula closed.

The Treatment of Cancer of the Skin by Divided Doses of High Voltage X Rays.

R. DRESSER AND C. E. DUMAS (*American Journal of Roentgenology and Radium Therapy*, September, 1936) state that in cancer of the skin the cosmetic results following irradiation are usually much better than those obtained by operation; and since a large percentage of epitheliomata are located on the face, irradiation is preferable to surgery. Complete surgical removal of a large epithelioma is often impracticable; and even though the disease may be eradicated by surgery, subsequent plastic operations are often necessary, which result in a long period in hospital for the patient and are not always successful. The authors regard daily divided doses of high voltage X rays as the best method of irradiating large cancers of the skin. A more uniform dosage can be applied to the area of malignant disease than is possible with radium needles, radon implants or low voltage X rays. The voltage was 200 kilovolts, and filtration 0.5 millimetre of copper. Lesions not exceeding 2.5 centimetres in diameter were given doses of 600 r each day, with a total dose of 2,400 to 3,000 r. Larger lesions were treated every day with doses of 300 to 400 r, the total dose being about 3,000 r. When very extensive growths are being treated, it may be necessary to extend the irradiation over a period of two to three months with total dosages as high as 8,000 r. Doses of less than 1,600 r were found to be inadequate. The results are quoted over a follow-up period of two years in eighty-five cases.

Treatment of Otitis Media and Mastoiditis by X Rays.

JOSEPH H. LUCUNUAN (*American Journal of Roentgenology and Radium Therapy*, December, 1936) describes inflammation of the middle ear and mastoid as characterized by congestion, lymphocytic and leucocytic infiltration, suppuration and finally resolution in uncomplicated cases. Chills are not common, fever is extremely variable; it may be entirely absent or it may rise as high as 40.5° C. (105° F.). Pain is always present in a variable degree. The uniformly favourable results obtained by X ray treatment in inflammatory processes elsewhere form the logical basis for the treatment of acute, subacute or chronic otitis media and mastoiditis by X rays. Experience in this field of therapy extending over a period of thirty years has shown conclusively

that X radiation applied early will promptly relieve pain, reduce fever and gradually bring about the disappearance of discharge. There is a well-founded, scientific basis for the uniformly successful results obtained by X ray treatment. It is well known that of all the body cells, lymphocytes are the most sensitive to X rays. The author has observed, further, that X radiation applied to the ear and mastoid destroys lymphocytic hyperplasia in and about the orifice of the Eustachian tube, thus relieving obstruction, restoring the function of hearing to normal, and removing a very probable source of reinfection. The action of X rays in chronic otitis media is analogous to its action in tuberculous adenitis and actinomycosis. The technique of treatment is given and consists of small doses of X rays over the ear and mastoid region. One dose is usually found to be sufficient. Fifty cases are quoted. The treatment was consistently followed by relief of pain, increased discharge, improved hearing and amelioration of the systemic manifestations of the disease. After treatment none of the patients with acute inflammation developed mastoiditis or perforation of the drum, and none of them required tympanotomy. Mastoiditis was already present when X rays were applied in nine cases, two of which later required mastoidectomy. In a control series of twenty-five cases in which X ray therapy was not applied, perforation of the drum occurred in five, mastoiditis developed in nine, mastoidectomy had to be done in five and tympanotomy in eleven.

The Treatment of Chronic Catarrhal Deafness by X Rays.

FREDERICK W. O'BRIAN (*Radiology*, January, 1937) states that the chronically deaf patients treated by him were all examined by a single otologist and the diagnosis of chronic catarrhal or secretory deafness was made. No patient with chronic suppurative middle ear disease or otosclerosis was treated knowingly. Each patient was sent for X ray treatment only after all the customary otological-therapeutic procedures had been practised without avail. Each patient had the commonly accepted hearing tests of deafness used before and after the X ray treatment. The same formula was used in the entire series and the physical set-up was checked at frequent intervals to keep the radiation as uniform as possible. The author gives details of the technique used. Seventy-three patients with chronic catarrhal deafness of a group of 140 with varying degrees of deafness were improved by X ray treatment. Eighteen patients with tinnitus in a group of twenty were cured. What is believed to be an optimum cycle based on certain definite X ray factors is described. The condition of sixty-five patients was unchanged, and two were made worse by X radiation. No patient with nerve deafness or otosclerosis was treated.

British Medical Association News.

SCIENTIFIC.

A MEETING of the Section of Neurology and Psychiatry of the New South Wales Branch of the British Medical Association was held at British Medical Association House, 135, Macquarie Street, Sydney, on December 3, 1936.

Stimuli and the Nervous System.

DR. D. W. H. ARNOTT read a paper entitled "A Study of Myelination and How It Helps in Understanding the Influence of Stimulus on the Development of the Nervous System" (see page 611).

DR. C. SWANTON read a paper entitled "Emotional Factors in Health and Disease" (see page 615).

DR. A. W. CAMPBELL said that Dr. Arnott's paper was full of facts and hardly bore criticism. In considering the development of myelinated nerve fibres in respect to function, however, it was well to bear in mind the existence of unmyelinated fibres, because, although less active, they performed important roles. For instance, in that simple reflex, the knee jerk, unmyelinated or very delicately myelinated fibres were intercalated and acted as a bridge for the carriage of impulses from sensory to motor neurones. Indeed, their destruction accounted for the absent knee jerk of *tibia dorsalis*.

Another observation of general interest bore upon sensory tracts, for example, that from skin to brain or that from retina to calcarine cortex. It was that they diminished in volume as they approached the "final common path". In other words, secondary and tertiary neurones became progressively less numerous than receptory. To illustrate this, the sum of the posterior roots might be compared with the columns of Goll and Burdach, meaning that impulses on their journey centralwards were culled, coordinated and integrated into affiliated complexes. But the same did not apply to motor tracts.

Dr. Campbell added, in reference to Dr. Swanton's paper, that various sites had been assumed as trigger points for emotional stimuli: first, the brain, as surmised by Descartes; secondly, the brain along with visceral parts; and thirdly, visceral parts of the nervous system alone, as maintained by James. It was in order to get light on the subject that Sir Charles Sherrington took an unfriendly dog and divided its spinal cord and vagi, so excluding visceral sensibility; and subsequent observation showed that the animal had not lost its unfriendliness. Dr. Campbell thought, however, that Sherrington was not altogether satisfied that in this regard the brain was everything and the viscera were nothing. He saw for one thing that the experiment did not explain the emotional vigour of an acephalic child.

DR. JOHN McGEORGE complimented both speakers on their papers. Although he had always regarded himself as one of the "mob" of critics of Freud, to which Dr. Swanton referred, he now had to admit that the excellent paper had almost converted him. There were, however, one or two statements with which he was not entirely in agreement. For example, that a child with a neurotic mother and an alcoholic father was destined to become a psychopath had been shown to be incorrect by a recent investigation, in America, of 138 children from broken homes. Of these, 75% were completely normal in spite of various neurotic and antisocial manifestations in the parents. Another statement which was open to criticism was that stammerers retained their impediments in a desire for sympathy. It had been found that many stammerers had compensated for this disability by achieving success in various intellectual pursuits, such as art, literature and music, and his own experience had been that they were very conscious of a sense of inferiority and extremely sensitive to the ribald comments of their associates. The majority seemed to strive earnestly to overcome their difficulties. He agreed with Dr. Swanton that the emotional element in conditions both functional

and organic was one that deserved more intensive investigation, and he appreciated the steps taken by him to draw attention to its importance.

With regard to Dr. Arnott's paper, Dr. McGeorge expressed approval of the fact that it conclusively proved that a psychiatrist could forsake the realms of psychological fantasy for those of a more intensely practical nature. The subject of myelination was an important one, and he was interested to hear that function could still be subserved in the absence of the sheath, although in an inferior way. It had been commonly held that the function of myelin was largely that of insulation. If this was still accepted, then we could understand how its absence would still allow the passage of impulses but tended to their dissipation before reaching their goal, much in the same way as an electric current through an uncovered wire. The paper opened up interesting avenues for exploration and pointed the way to a greater study of the relationship between structure and function, and for this reason was of particular value.

DR. H. M. NORTH said that Dr. Swanton and Dr. Arnott were to be congratulated on having presented very valuable papers to the section. Both papers offered much food for thought, and he was sure that they would provoke a very interesting discussion. If he had followed them aright, both papers went to show how structure frequently followed function. Dr. Arnott demonstrated this in the highest levels of the nervous system, where ultimate structural patterns might depend on the nature of the stimuli received. It seemed to him that this must be true from other considerations as well as those supplied by histology. For in what else did the whole process of education consist? In what way, for instance, did the expert cricketer or tennis player differ from the man in the street, if it were not that training had established new patterns in the cerebral cortex as well as developed the appropriate muscle groups?

DR. SWANTON, on the other hand, gave reasons for believing that morbid structural changes in bodily organs, such as those seen in gastric ulcer and those following asthma, might arise in the beginning from emotional causes. And he, too, had made out a very good case.

DR. W. S. DAWSON expressed his appreciation of and interest in both papers. As Dr. Arnott's paper might logically be considered to come first, he would like to remark that unless there were some predisposition or innate tendency to follow certain paths, the passage of impulses through the nerve syncytium would be chaotic. There must from an early stage be a tendency for nerve impulses to follow certain tracks. Dr. Arnott had raised without settling the question as to the relation between innate and acquired characteristics. In practice it was assumed that the organism was educable from an early age, and an attempt was made to direct and control the stimuli which fell upon the young organism. Perhaps there was a risk of over-stimulation in present-day education.

Perhaps Dr. Dawson misunderstood something that Dr. Swanton had said, but surely stammerers suffered more from their social environment than anything they might gain, especially at school. He doubted whether sufficient allowance was made for general inadequacy in neurotics. So much of treatment was rightly directed towards making the environment more tolerable for these individuals, especially the psychological environment of the family. Another point insufficiently recognized was the enormous factor of suggestion in the treatment of neurotics. Through the appeal of the novel and the mysterious and through advertisement, quacks had a considerable advantage over the medical profession.

DR. OLIVER LATHAM welcomed Dr. Arnott's paper, as he was well aware from personal experience of the difficulty of getting at even a few of the ideas on "myelination" included by the speaker. He hoped the lecture material would be made available for permanent reference. He evidenced this by alluding to pink disease and its elusive etiology. Some would have a cellular infiltration of the grey horns as a distinctive feature, but Dr. Latham had seen this only once in eight cases. More remarkable still

was the view put forward by some American writers, who suggested an analogy with the deficiency diseases like the combined scleroses—this because so many of the little spinal cords exhibited a paling of the lateral columns in Weigert-Pal stained sections. Noticing this fact, Dr. Latham had procured and similarly prepared sections of cords of children dying of many diseases, chiefly before they were twelve months old (most children with pink disease were less than a year old), and he had noted this paling in all of them. Dr. Latham would also like to remind his hearers that Professor Wilkinson, with his modified osmotic acid technique, had brought evidence to show that even the smallest supposed unmyelinated nerve fibre had a definite, if meagre, myelin coat. Disseminated sclerosis sometimes swept away myelin like a dissolving agent, and this was nowhere better seen than in the anterior horns in Weigert-Pal preparations. He liked to hear Dr. Campbell's contribution to the discussion, reminding them as it did of his happy work in the field of myelinated fibres. Dr. Swanton had presented current views on psychotherapy and some of his own views in a most adequate manner, and the fact that he could do so only showed how well this branch of medicine had been established.

Dr. J. A. L. WALLACE said that Dr. Swanton's paper called attention to the very important subject of the relations of emotion and disease. They frequently noted in the reports from the workers' compensation courts how many cases there were of claims that would come under this class.

Dr. Arnott's paper was interesting in bringing into closer association the two subjects of psychiatry and neurology, as Dr. Arnott was mainly a psychiatrist. Recently in the English journals attention had been called to the controversy over the relations of the two subjects, and regret that there should be any marked dissociation. The present-day medical officer in the mental hospitals, who had obtained the diploma in psychiatry, had a good working knowledge of neurology, which helped to diminish the separation of the two subjects.

Dr. K. MADDOX expressed his appreciation of Dr. Swanton's paper, and stated that it would have been of great advantage to all members of the Section of Medicine; a subject of this character should be considered at a committee meeting of the two sections. The whole trend of modern therapy was towards a further understanding of the psychological aspects influencing the course and symptomatology of disease processes, and the physician of the future would unquestionably be fitted to comprehend and benefit by the psychological background of his patient's diseases. Provision had already been made by the Medical Research Council for further instruction in normal and abnormal psychology at the very commencement of the clinical period of a student's curriculum, so that henceforth the undergraduate would have a wider outlook upon this very essential aspect of his clinical training.

Many diseases formerly considered as entirely organic and dependent upon well-recognized hereditary factors or disorders in metabolism, had been recognized as requiring some form of psychological disturbance for their maturation. A common example was peptic ulcer. Whereas textbooks laid down definite criteria for its differentiation from functional gastric disorders, practitioners would readily agree that such discrimination was extremely difficult. Dr. Maddox had recently seen two patients whose condition had for some years been considered as unquestionably functional in type, but who had both suddenly suffered from haematemesis. Indeed the efficacy of the histidine treatment for peptic ulcer might largely depend upon suggestion. The association received support from the occasional development of peptic ulceration in the course of newgrowths in the region of the diencephalon, and from the fact that repeated injections of extract of the posterior pituitary lobe in a rabbit would produce typical peptic ulceration. The psychical disturbance located in the cortex might possibly influence the nerves and vessels of the stomach by way of the hypothalamus.

Continued observations of a large number of diabetics had convinced Dr. Maddox of the ease with which worry

and anxiety could influence the delicate balance of carbohydrate metabolism. Many such patients, who for long periods were satisfactorily stabilized in a constant diet and insulin intake, would suddenly show wide variations in the blood sugar level following bereavement or economic upset.

Dr. Maddox was sorry that Dr. Swanton had not had time to devote to the subject of the psychological relationships of the cardio-vascular disorders, as this was a very wide and important field, which could scarcely be overstressed.

Dr. Swanton, in reply, said that Dr. Dawson had misunderstood him in regard to stammering. He quite agreed that the stammerer did not consciously want to have a stammer originally, but that the stammer having developed, it was made use of very definitely both as a weapon and more especially as a protection to his ego, and that eventually the stammer became so valuable to him that he was really loath to part with it. Dr. Swanton assured Dr. Dawson that his information came directly from the stammerers themselves. He also agreed with Dr. McGeorge that stammerers had an inferiority complex in the generally accepted sense. The inferiority complex was, of course, a not very well disguised superiority, the inferiority protecting the patient from having to live up to his exaggerated idea of himself and fear of not being equal to the task. Hence the value of the stammer. "What I could do if I didn't stammer." It also explained why they did so well in stammerers' clubs *et cetera*. As regards suggestion, Dr. Swanton said he was not in any way opposed to it; it was a very valuable method of treatment, used by every doctor daily. Most of the quacks used more than suggestion and actually gave patients absolution.

To the hounded neurotic who had been told by all and sundry that there was nothing wrong with him and to pull himself together (his inability to do so being his complaint actually), the osteopath said: "Yes, you have been misunderstood; you have a disease and we will put it right." Which he did by the powerfully suggestive method of strenuous physical manipulation. The relief to the patient's guilt, the combination of absolution and suggestion was a very powerful weapon. So were the Salvation Army and Christian Science. Dr. Swanton, though not a Freudian, said he was in agreement with most of Freud's teachings, and paid a tribute to Freud and his vast influence in the development of dynamic psychology.

Dr. Arnott thanked the speakers for their kind remarks. As an excuse for inflicting such a dry subject upon members of the section, he felt that only by a proper understanding and study of the early development of the brain and its mental functions could the cause of mental and nervous diseases be ascertained. He agreed with Dr. Dawson that there was a predisposition or innate tendency for nerve impulses to follow certain tracts in the neural syncytium. This was seen in the old brain and even parts of the new, as evidenced by the long association tracts, but did not seem to extend to the most recent parts of the brain, where evolution took place in response to the environmental stimuli of life.

A MEETING of the Victorian Branch of the British Medical Association was held at Saint Vincent's Hospital, Melbourne, on November 18, 1936. The meeting took the form of a series of clinical demonstrations by members of the honorary staff. Part of this report appeared in the issue of April 10, 1937.

Cancer of the Cheek, Lips and Tongue.

DR. JOHN O'SULLIVAN showed patients suffering from cancer of the cheek, lips and tongue, also three patients with epithelioma of the limbus region of the eye, who had been treated with radium and radon implantation. He also showed a patient suffering from lymphosarcoma of the mediastinum, who had been treated with a combination of Coley's fluid injections and high voltage therapy.

Radiological Demonstration.

Dr. O'Sullivan explained the technique of Lipiodol injection into the bronchial tree with an introducer for the intratracheal catheter designed by himself. Skiagrams and pathological specimens of cases of bronchial carcinoma, periosteal sarcoma arising from the first rib and simulating a mediastinal growth, as well as an interesting case of Paget's disease, with multiple periosteal sarcomatous growths from the bones of the skull and from the femur, were also shown.

Cardiospasm.

DR. CHARLES OSBORN showed a female patient, aged thirty-seven years, who for the past six years had experienced pain when swallowing food and a sensation of stoppage of the gullet. There had been frequent vomiting of undigested food and continuous loss of weight. Characteristic skiagraphic findings of cardiospasm were demonstrated. The patient had had previous treatment elsewhere with dilators, which had proved unsatisfactory. Operation and transgastric dilatation of the cardiac orifice had given complete relief of all symptoms, and subsequent skiagraphic examination revealed the present condition of the oesophagus, which, though smaller than it had been, was still somewhat dilated.

Penetrating Gastric Ulcer.

Another patient shown by Dr. Osborn was a male who gave a history of severe dyspepsia for twelve years, with haematemesis, frequent melena and loss of weight. The pre-operative treatment was discussed; it had included a high calorie diet with frequent feeds, blood transfusion and administration of fruit juices.

Another patient with penetrating gastric ulcer shown by Dr. Osborn was a male, forty-eight years of age, who had a ten years' history of dyspepsia with severe epigastric pain for the past year. A skiagram had revealed a penetrating ulcer very high on the lesser curvature. A strict dietary régime with histidine produced complete relief of symptoms, with an increase of weight amounting to two stone. A skiagraphic follow-up had shown progressive diminution of the large ulcer crater, so that at the time of the meeting only a very small deformity could be detected.

Dr. Osborn also showed a male, aged thirty-seven years, who had been admitted to hospital with a condition that was regarded as subacute appendicitis. Investigation had revealed an ulcer on the posterior wall of the stomach, near the pylorus, and occult blood was found in the faeces. Dr. Osborn said that he had demonstrated the patient to illustrate the radiological technique carried out by Dr. John O'Sullivan in these conditions.

Perforated Gastro-Jejunal Ulcer.

Another patient shown by Dr. Osborn was a male, aged twenty-nine years, on whom gastro-enterostomy had been performed elsewhere for chronic duodenal ulcer. An emergency operation had been performed for closure of a perforation on the stomach side of the anastomosis, which had been performed three months before the meeting. Following a period of dietetic treatment it was decided that further surgical interference should be undertaken on account of the patient's age and occupation, which precluded him from maintaining a strict dietary. At the second operation, gastro-enterostomy was done and a partial resection of the anterior wall of the pylorus and first part of the duodenum was carried out. Dr. Osborn showed skiagrams to illustrate the result.

Hour-Glass Stomach.

Another patient shown by Dr. Osborn was a male, aged forty-eight years, who gave a long-standing history characteristic of peptic ulcer with deep penetration into both the liver and pancreas. The operation undertaken was a Finsterer non-return gastrectomy; and the technical details of the operation were discussed and illustrated, together with the method of anaesthesia most commonly used by Dr. Osborn in these cases—regional anaesthesia,

in which the abdominal wall was blocked with 0·5% "Novocain", and with intraabdominal instillation of 0·1% "Percaine" solution.

Films of Severe Fracture-Dislocation of the Cervical Vertebrae.

DR. THOMAS KING demonstrated a cinema film which illustrated the management of a severe case of fracture-dislocation of the cervical vertebrae. Four days after the patient's admission to hospital the left arm had become partly paralysed, and also the bladder, owing to the development of oedema of the spinal cord. The deformity had not up to that time been reduced, because the patient could not tolerate the Glisson sling, and her poor general health prevented the application of a plaster cast. The progressive character of the oedema of the cord, especially in the presence of deformity, necessitated the immediate reduction of the fracture-dislocation by traction, hypertension and manipulation forward of the segment of the spinal column distal to the injury. The reduction was then maintained by traction on the frontal bones with Crutchfield's calipers and hyperextension with a pillow behind the neck. The special drills for inserting the blunt points of the calipers into the outer table of the skull only prevented any danger of piercing the cranial cavity. After ten days the calipers were removed and a plaster cast was applied. It was essential in all severe displacements to include a thumb-screw in the cast, so that it could be pressed forward on the spinous process distal to the injured part; otherwise displacements occurred.

Coccygeal (Pilonidal) Cysts.

DR. F. J. COLAHAN showed a series of patients with coccygeal (pilonidal) cysts, who had been operated on by the Lahey technique (double pedicle flap). All the wounds except one had healed by first intention. Dr. Colahan drew attention to the difficulty associated with the entire removal of the cysts. He had overcome this by injecting the primary sinus with melted paraffin wax. The wax quickly solidified, and if an outlying extension of the cyst was cut across, it showed up readily as a white worm of wax against the yellow fat.

Urological Conditions.

DR. ARTHUR LAZARUS showed pyelograms of bilateral dilatations of the kidneys of congenital origin.

Dr. Lazarus showed a male patient, aged fifty years, who had complained of attacks of pain in the left loin for one year. After an attack the patient noticed that he passed "dirty" urine. There was no abnormal frequency of micturition, and on examination there was no tenderness in the loin and no mass was palpable. Cystoscopy and intravenous injection of indigocarmine resulted in moderate blue appearing from the right ureter in ten minutes and faint blue from the left ureter in fifteen minutes. The pelvis of the left kidney, when injected with 10% sodium iodide solution, held thirty cubic centimetres without pain, but on the right side the injection of fifteen cubic centimetres caused pain. No evidence of infection was found in the urine from the right kidney, but the specimen from the left kidney was grossly infected. Left nephrectomy was performed.

Another patient shown by Dr. Lazarus was a woman, aged thirty-one years, who had complained of a dull pain on the right side of the abdomen and in the right loin for four years following her first pregnancy. There had been no abnormal frequency of micturition, and on examination both kidneys were readily palpable. Cystoscopy and intravenous injection of indigocarmine resulted in the appearance of blue from the right ureter in ten minutes, but no blue was seen from the left side. The pelvis of the right kidney, when injected with sodium iodide, held thirty-five cubic centimetres without causing the patient pain, and the injection of forty cubic centimetres on the left side was also without pain. The urine from the right kidney yielded a few pus cells, but there had been no pus in the left kidney specimen. The blood

urea was estimated at twenty-eight milligrammes per hundred cubic centimetres. In the treatment that was carried out, the right ureter was dilated to size French 8; and following the dilatation the patient had been free from pain for two months at the time of the meeting.

Another patient shown by Dr. Lazarus was a woman, twenty-four years of age, with a solitary kidney. The patient had complained of scalding during the passing of urine. There had been no abnormal frequency of micturition, and on examination the left kidney had been readily palpable, but the urine was grossly infected. Cystoscopy showed the left orifice to be in the 2 o'clock position, but the right orifice was not seen. Intravenous injection of Indigocarmine resulted in the appearance of blue from the left ureter in five minutes; the right orifice was not identified. A left pyelogram had shown moderate pyelectasis and an intravenous urogram ("Uroselectan B") showed a good left kidney shadow with evidence of the dye in the left pelvis and ureter. Dr. Lazarus said that five pictures had been taken, the last one two hours after the injection, and that no picture had shown the existence of a right kidney.

Hypochromic Anæmia.

DR. ERIC COOPER and DR. J. E. BYRNE showed three patients with hypochromic anæmia to illustrate the response to treatment with iron and ammonium citrate given in doses of ninety grains per day. One was a male patient, aged fifty-five years, who was suffering from cirrhosis of the liver. Pallor, insomnia and abdominal discomfort had been present for two years, and occult blood was found in the feces. At laparotomy the liver was found to be enlarged, though the spleen was not enlarged, and nothing abnormal was detected in the stomach. In March, 1936, the red cells numbered 2,900,000 per cubic millimetre and the haemoglobin was estimated at 60%. A few weeks later, after intramuscular injection of a liver extract, there was no reticulocytosis, and treatment was commenced. In July the red cells numbered 4,900,000 per cubic millimetre and the haemoglobin value was 79%. By October the red cell count had risen to 5,200,000 per cubic millimetre and the haemoglobin value to 90%.

The second patient was a woman, aged forty-eight years, who had suffered from menorrhagia for six months. Abdominal discomfort had been present for years, and she had complained of headaches and dyspnoea on exertion. The tongue was pale and glazed, and the spleen was not palpable. In December, 1935, the red cells numbered 4,200,000 per cubic millimetre and the haemoglobin value was estimated at 45%. Treatment with the iron preparation was commenced, but there was no material improvement after three months. In May, 1936, hysterectomy was performed and the iron treatment was continued. By October the red cell count had risen to 6,500,000 per cubic millimetre and the haemoglobin value reached 100%.

The third patient shown by Dr. Cooper and Dr. Byrne was a woman, aged thirty-eight years, who had been suffering from extreme pallor and discomfort in the limbs for some months. On examination the tongue was pale and glazed and the edge of the spleen was palpable. In October, 1935, the red cells had numbered 3,200,000 per cubic millimetre and the haemoglobin was estimated at 42%. The patient was treated with iron and ammonium citrate in doses of ninety grains per day, and in October, 1936, the red cells had risen to 6,500,000 per cubic millimetre and the haemoglobin value was estimated at 80%.

Familial Achromic Jaundice.

Dr. Cooper showed two patients who were members of a family in which jaundice with splenic enlargement had been present in three generations. In the first generation three out of five members were known to be affected, and the spleen was removed in one case with success.

Mrs. A., a member of the second generation, had had her spleen removed in 1921 at the age of fourteen years after investigation had established that she was the subject of familial acholuric jaundice. In the third genera-

tion one child had died after splenectomy and another at seven years of age with anæmia and nephritis, and twin children had died when three months old with severe anæmia.

The two remaining members of the family of the third generation were boys, ten and nine years of age respectively. The younger brother had escaped the familial condition, but the older brother, Robert, was shown by Dr. Cooper. The yellow colour of his skin had been noticed at birth; there had been recurrent exacerbations and remissions, and he had been subject to attacks of colicky pain in the right upper portion of the abdomen. The head had always been large and the change was very striking on account of thickening of the bones of the vault of the skull. The alteration of the shape and size of these bones had led to the development of exophthalmos and had given the facies a mongoloid appearance. In the radiogram the thickening was seen to be due largely to vertical radiations like "hair growing from the inner table". In other respects the clinical and laboratory findings conclusively established the diagnosis of familial acholuric jaundice. Dr. Cooper also showed museum specimens of the liver, spleen and skull of one of the older brothers. In this specimen of the skull the peculiar bone changes were readily demonstrated.

Amœbic Dysentery.

DR. FRANK J. NIALL showed a patient who was suffering from amœbic dysentery. The man, aged forty-three years, had been admitted to Saint Vincent's Hospital on June 12, 1936. Two months previous to admission he had developed diarrhoea, with six to seven motions during the day and six or more at night; the motions had been watery, containing blood, and there had been occasional colicky pains in the lower part of the abdomen before the bowels moved. The patient had lost two stone three pounds in weight in two months. There had been no other symptom. Dr. Niall said that the patient had suffered from an abscess on the buttock seven to eight years before the meeting; he had undergone an operation for hernia in 1912, and he had also lost an arm through a gunshot wound during the War in 1917. A sigmoidoscopic examination had been made on June 16, 1936. The mucous membrane of the whole of the rectum and of the proximal part of the sigmoid was intensely engorged and inflamed, with a fair quantity of muco-pus and blood; the membrane bled easily; no ulceration was seen and there was no evidence of malignant disease to this level. General examination disclosed nothing abnormal. The patient had been treated for a time with colonic lavage, but had made no progress, though the temperature remained normal. A barium enema on June 27, 1936, had shown a plastic sigmoid; tannic acid wash-outs had been given (1 in 2,000), but the patient still had every day six to seven motions containing blood. On July 3, 1936, examination of the stools revealed *Entamoeba histolytica* in great numbers, and there had been a large number of red blood corpuscles in the amoebæ. The patient had been given emetine, half a grain, twice a day for one week. Dr. Niall said that within twenty-four hours of the first injection the diarrhoea had ceased and had not recurred. The emetine was continued for one week, during which time enemas had been necessary to establish the bowel action; there were no ill-effects from the injections. Dr. Niall said that the patient, when closely questioned, remembered an attack of diarrhoea a few days before he was wounded in 1917, but no other similar attack.

Dr. Niall had shown this patient to emphasize the long period of quiescence, eighteen years, and the dramatic response to emetine within twenty-four hours. The patient was quite well and had regained the weight that he had lost; he was at the time undergoing a second course of injections of emetine as a prophylactic measure.

Epithelioma of the Forearm with Thiersch Grafting.

DR. E. W. GAULT showed a patient to illustrate the removal of an epithelioma of the forearm with immediate Thiersch grafting of the area over which the skin could not be approximated. The tumour had been present for

two years. The patient was a male, seventy-two years of age. A section revealed a chronic epithelioma, and no glands had been palpable. Dr. Gault said that the whole area had healed in six weeks' time.

Carcinoma of the Breast with Paget's Disease of the Nipple.

Dr. Gault also demonstrated a case of carcinoma of the breast with Paget's disease of the nipple, which had been present for one year. Large hard glands were present in the axilla and the nipple had been definitely retracted, lying over a palpable mass. The patient had presented herself at the out-patient department for a recurring trouble with varicose veins, which had been excised some years before, and she had mentioned the breast purely incidentally; the liver had not been palpable.

(To be continued.)

Correspondence.

LABORATORY FACILITIES AT OBSTETRICAL HOSPITALS IN SYDNEY.

Sir: Dr. Chesterman's letter opens up a broader issue which urgently needs the attention of Government, profession and the Hospital Commission.

It can be simply expressed in question form. In the eyes of the State, profession and public: (a) What is a pathologist? (b) What is her or his status (i) in relation to other branches of medicine, (ii) financially?

These questions can be answered crisply, at any rate as they apply in Sydney: (a) Quite undefined (from an ex-bottle-washer upwards!). (b) (i) Pathology is the Cinderella, least of all considered, medical specialty, and this in spite of the world-wide recognition of the value of the contributions of real pathologists to the general sum total of medical knowledge and the admitted help they daily give the physician, surgeon and other practitioner. (ii) Usually hopeless, for though his brothers and sisters of the medical profession expect a lot from him and trust him extensively, both they and the public (which can only be educated by the medical man or woman) seem to imagine that the laboratory worker lives and thrives on the love of his calling and the aromatic odours of his scientific lair.

There is a wise rule of the General Medical Council and the British Medical Association against "covering" a layman, but in certain specialties the utilization of the services of a trained technician under the personal supervision of a medical man or woman is permitted. Every medical practitioner in this city must know how loosely this elastic provision is applied.

I can state of first hand knowledge of:

A. A partly trained nurse in charge of a department who sees her "honorary" occasionally, who is entirely responsible for the conduct of vaccine making, blood counts *et cetera*, and who was unable to recognize an eosinophile!

B. In court recently a young layman gave evidence on oath: (i) That he was an "expert" (pathologist). (ii) That he habitually did blood counts on which his honorary later reported without having seen the case. (iii) That he could detect a 10% variation in the leucocytes during the day! (His honorary later admitted to a possible 20% error in the best technique, but unfortunately also admitted that he did not know what time the patient had his blood taken, and had not seen the case at the time of test.)

C. In several hospitals the pathologist does not "pathologize" sufficiently to undertake the preparation and diagnosis of malignant tissue, Wassermann or Kahn tests

et cetera. These are sent to the Board of Health or to some other person or institution who may do them at cut rates or gratuitously; but the "pathologist" often signs the report and for this service draws some sort of a dole from the institution.

All this is not merely wrong; it is belittling to the specialty of pathology, and if it is permitted by our Association any longer, the British Medical Association is inconsistently hypocritical. The *fons et origo* of the whole trouble is the general opinion in Australia that the medically trained pathologist as a "good ass". He has been, and it is time he woke up!

Just because some of us have loved our work for its own sake, we should not be any longer blind to the comparative paucity of the rewards for our labour, but more especially we should insist against the belittling of our special calling by the employment of nurses and technicians and the assumption that any old corner with a microscope and hand centrifuge can be considered a working background for the properly trained and experienced pathologist.

The surgeon would doubtless perform very much if a trained layman was allowed to do his operations (though even this was once done in Sydney), and if he was asked to operate in a cellar. The physician would justifiably lift his voice if nurses and laymen treated his cases and he was left merely to sign the death certificates. And yet why is the status of the pathologist different from that of other specialists?

Chiefly, I think, because there are more surgeons and physicians and the pathologist is "small beer" because he has long, long and tamely submitted to the way he has been relatively ignored by his own profession and Association (sorry to say it) just because he has a "scientific complex".

Financially? Why does the patient, and the general practitioner often also, consider that a *bona fide* pathologist is scandalously overpaid when he asks two or three guineas for a visit, and a blood count, if properly done, involves at least one or two and often three hours' hard work? Is the diagnosis of a malignant growth, accurately given by an experienced man or woman, of less value than the operation to remove it? But the pathologist who has spent many years to acquire a relative accuracy may get two to five guineas for a diagnosis of lip cancer, the surgeon who snips it out "!".

The solution and the only solution to which our Association and the Medical Board can, I think, find acceptable, ethical and equitable is this.

1. Reserve the term "pathologist" for a medical man or woman of at least ten years' standing or equivalent special qualifications, including ample opportunity of malignant diagnosis.

2. Properly train and examine, then register and certificate all pathological (and incidentally other) technicians.

3. Definitely fix their field and penalize their overstepping its borders.

4. Insist on the visiting pathologist at least establishing personal contact with the patients at the hospital laboratories on which he reports, and insist that his personal supervision of his lay assistant amount to something more adequate than the signing of a report.

5. Make it unethical to hold multiple "honorary" or remunerative positions at more hospitals than can reasonably be served.

6. Preferably insist that all pathologist appointments be for a definite reasonable number of hours' attendance per week and be adequately paid.

7. Let the British Medical Association or the Medical Board be the advisory authority *re* the capacity of candidates for pathological positions at all hospitals, and so reestablish the real meaning of the word pathologist, that so many fine labourers in the field made a thing of respect, not the mere label of anyone who can stain a tubercle bacilli sputum *r* a gonococcal smear.

8. Best of all perhaps, make all senior pathological positions be full-time jobs. The senior pathologist would

gradually train his junior to qualify himself as a real pathologist.

9. Strictly enforce the edict against covering by the usual penalty.

Yours, etc.,
BURTON BRADLEY.

"Wyoming",
Macquarie Street,
Sydney,
March 31, 1937.

Congress Notes.

HOTEL ACCOMMODATION.

THE Executive Committee of the fifth session of the Australasian Medical Congress (British Medical Association), to be held at Adelaide from August 23 to 28, 1937, has forwarded the information regarding hotel accommodation that is set out in the table below.

This information is believed to be correct, but the Accommodation Committee does not hold itself responsible for any inaccuracy, or for the rates or tariffs shown.

Intending visitors are recommended to make reservations direct with the hotel managers beforehand, stating fully the type of accommodation required and the dates. This may also be arranged through the Secretary of the Accommodation Committee (Dr. M. T. Cockburn, 170, North Terrace, Adelaide).

The "Accommodation for" column shows the maximum normal capacity of the premises, but naturally the hotels are prepared to make only a proportion of their accommodation available during congress week.

University Intelligence.

THE UNIVERSITY OF SYDNEY.

A MEETING of the Senate of the University of Sydney was held on April 12, 1937.

The following degrees were conferred:

Bachelor of Dental Surgery (B.D.S.): Clifford Ralph Boge, John Brodie, Lyndon Harold Johnston, Sydney Levine.

The Diploma in Public Health was awarded to Francis Bede McCann, M.B., Ch.M.

The following appointments were approved: Dr. W. E. Fisher as Tutor in Medicine at Sydney Hospital during the absence of Dr. E. H. Stokes on leave; Mr. J. S. Hill as Junior Demonstrator in Prosthetic Dentistry for Lent and Trinity terms; Dr. Garnet Halloran as Acting Lecturer in the Diseases of the Ear, Nose and Throat for 1937; Mr. J. Bannon, B.Sc., as Demonstrator in Physics.

Science Research Scholarships for 1937 were awarded to: Miss Joyce Cooper, Pharmaceutical Science; Mr. K. J. Baldick, Organic Chemistry; Miss Valerie M. B. May, Botany; Mr. E. T. Ritchie, Chemistry.

Associate Professor Priestley was appointed a member of the Cancer Research Committee.

The subject of biology was added to the list of science subjects approved for the matriculation examination.

The Senate received from a graduate of many years' standing a cheque for £88 in repayment of fees remitted to his son whilst attending the courses for the B.Sc. degree. The Senate recorded its appreciation of the generosity of the graduate who had taken this action as soon as his circumstances permitted him to do so.

	Name of Hotel.	Address.	Accommodation for.	Tariff from		
				Bed and Breakfast.	Per Day.	Per Week.
ABCDEF	South Australian ..	North Terrace, Adelaide	120	s. d. 12 6 12 0 13 6 17 6	s. d. 21 0 17 6 20 0 25 0	£ s. d. 7 0 0
ABCDE	Hotel Richmond ..	128, Rundle Street (Bedroom with private bathroom)	80			
ABCDEF	Hotel Napoleon ..	King William Street	35	10 6	14 6	4 10 0
BCDE	Hotel Botanic ..	North Terrace	30	10 0	16 0	4 10 0
ABCDE	Hotel Ambassadors ..	King William Street	42	10 6 12 6	17 6 20 0	4 10 0
ABCDE	Oriental	Rundle Street	50	10 6 12 6	17 6 21 0	5 12 6 6 10 0
BE	Majestic	King William Street	30	8 6	10 6	3 3 0
BE	Southern Cross	King William Street	35	8 0	10 6	3 3 0
ABE	Hotel Rundle	Rundle Street	30	—	12 0	4 4 0
ABE	Hotel Adelaide	Pirie Street	35	7 0	10 0	3 3 0
E	Black Bull	Hindley Street	35	6 0	10 0	3 3 0
ABCDEF	Grosvenor (unlicensed) ..	North Terrace	310	6 0	10 0	3 2 6
E	Victoria	94, Hindley Street	42	5 6	8 6	2 10 0
Northern Suburb.						
E	Cathedral	45, Kermode Street, North Adelaide..	20	6 0	10 0	3 3 0
Seaside Resorts.						
E	Pier Hotel	2, Jetty Road, Glenelg	90	10 6 10 6	12 0 14 0	3 10 0 4 4 0
BCE	Hotel St. Vincent	28, Jetty Road, Glenelg	40	7 6 8 6	12 0 15 0	4 4 0 5 5 0
	Largs Pier	Esplanade, Largs Bay.. ..	28	6 0	10 6	3 3 0

A=Bedrooms with private bathrooms.

B=Hot and cold running water in bedrooms.

C=Bedrooms with private telephones.

D=Reading lamps in bedrooms.

E=Hot and cold running water in bathrooms.

F=Rooms with private bathrooms extra.

Obituary.

ARTHUR JEFFREYS WOOD.

We regret to announce the death of Dr. Arthur Jeffreys Wood, which occurred on April 8, 1937, at East Melbourne, Victoria.

JOHN PHILLIP O'BRIEN.

We regret to announce the death of Dr. John Phillip O'Brien, which occurred at Adelaide on April 17, 1937.

Diary for the Month.

APR. 27.—New South Wales Branch, B.M.A.: Medical Politics Committee.
APR. 28.—Victorian Branch, B.M.A.: Council.
APR. 29.—New South Wales Branch, B.M.A.: Branch.
APR. 29.—South Australian Branch, B.M.A.: Branch.
MAY 4.—New South Wales Branch, B.M.A.: Organization and Science Committee.
MAY 5.—Victorian Branch, B.M.A.: Branch.
MAY 5.—Western Australian Branch, B.M.A.: Council.
MAY 6.—South Australian Branch, B.M.A.: Council.
MAY 7.—Queensland Branch, B.M.A.: Branch.
MAY 11.—New South Wales Branch, B.M.A.: Executive and Finance Committee.
MAY 14.—Queensland Branch, B.M.A.: Council.
MAY 18.—New South Wales Branch, B.M.A.: Ethics Committee.
MAY 19.—Western Australian Branch, B.M.A.: Branch.
MAY 20.—New South Wales Branch, B.M.A.: Clinical Meeting.
MAY 25.—New South Wales Branch, B.M.A.: Medical Politics Committee.

Medical Appointments.

Dr. G. A. Thompson has been appointed Government Medical Officer at Hay, New South Wales.

Dr. I. H. Mackay has been appointed Government Medical Officer at Moruya, New South Wales.

The following appointments have been made at the Adelaide Hospital: Dr. M. W. Fletcher, Honorary Anesthetist; Dr. C. B. Sangster, Honorary Clinical Assistant to the Tuberculosis Section; Dr. G. H. B. Black, Honorary Assistant Ophthalmologist.

Medical Appointments Vacant, etc.

FOR announcements of medical appointments vacant, assistants, locum tenentes sought, etc., see "Advertiser", pages xvi to xix.

AUSTRALIAN AERIAL MEDICAL SERVICES, SYDNEY, NEW SOUTH WALES: Medical Officer.
CHILDREN'S HOSPITAL (INCORPORATED), PERTH, WESTERN AUSTRALIA: Junior Resident Medical Officer.
COMMONWEALTH OF AUSTRALIA, DEPARTMENT OF HEALTH: Medical Officer.
DEPARTMENT OF PUBLIC HEALTH, NEW SOUTH WALES: Assistant Medical Officer of Health.
INSTITUTE OF MEDICAL SCIENCE, ADELAIDE, SOUTH AUSTRALIA: Research Pathologist.
ROYAL MELBOURNE HOSPITAL, VICTORIA: Honorary Officers.
TARA DISTRICT HOSPITAL, TARA, QUEENSLAND: Medical Officer.
THE PUBLIC SERVICE BOARD, ADELAIDE, SOUTH AUSTRALIA: Assistant Bacteriologist.
THE WOMEN'S HOSPITAL, CROWN STREET SYDNEY, NEW SOUTH WALES: Resident Medical Officers.

Medical Appointments: Important Notice.

MEDICAL PRACTITIONERS are requested not to apply for any appointment referred to in the following table without having first communicated with the Honorary Secretary of the Branch named in the first column, or with the Medical Secretary of the British Medical Association, Tavistock Square, London, W.C.1.

BRANCHES.	APPOINTMENTS.
NEW SOUTH WALES: Honorary Secretary, 125, Macquarie Street, Sydney.	Australian Natives' Association. Ashfield and District United Friendly Societies' Dispensary. Balmain United Friendly Societies' Dispensary. Friendly Society Lodges at Casino. Leichhardt and Petersham United Friendly Societies' Dispensary. Manchester Unity Medical and Dispensing Institute, Oxford Street, Sydney. North Sydney Friendly Societies' Dispensary Limited. People's Prudential Assurance Company Limited. Phoenix Mutual Provident Society.
VICTORIAN: Honorary Secretary, Medical Society Hall, East Melbourne.	All Institutes or Medical Dispensaries. Australian Prudential Association, Proprietary, Limited. Mutual National Provident Club. National Provident Association. Hospital or other appointments outside Victoria.
QUEENSLAND: Honorary Secretary, B.M.A. House, 225, Wickham Terrace, Brisbane, B.17.	Brisbane Associate Friendly Societies' Medical Institute. Proserpine District Hospital. Members accepting LODGE appointments and those desiring to accept appointments to any COUNTRY Hospital are advised, in their own interests, to submit a copy of their Agreement to the Council before signing.
SOUTH AUSTRALIAN: Honorary Secretary, 178, North Terrace, Adelaide.	All Lodge appointments in South Australia. All contract Practice Appointments in South Australia.
WESTERN AUSTRALIAN: Honorary Secretary, 205, Saint George's Terrace, Perth.	All Contract Practice Appointments in Western Australia.

Editorial Notices.

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